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RDTE PROJECT NO.
AVSCOM PROJECT NO. 70-15-2
USAASTA PROJECT NO. 70-15-2

VIBRATION AND TEMPERATURE SURVEY PRODUCTION UH-1H HELICOPTER

FINAL REPORT

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UNITED STATES ARMY AVIATION SYSTEMS TEST ACTIVITY
EDWARDS AIR FORCE BASE, CALIFORNIA 93523

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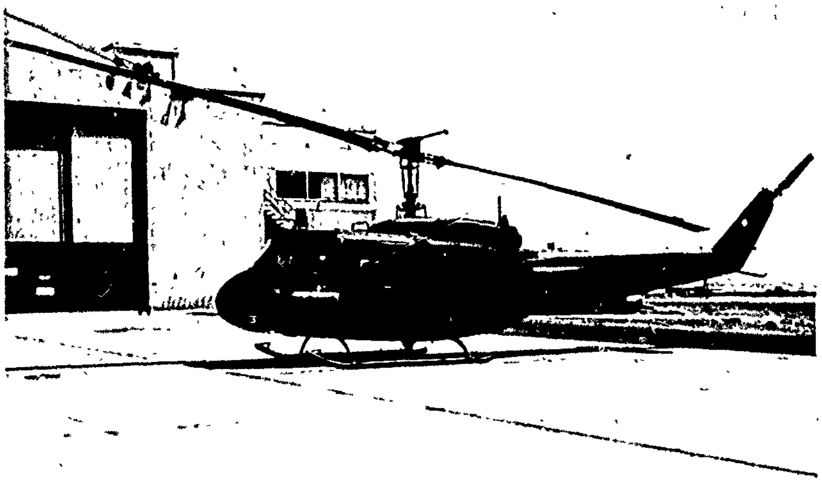
ABSTRACT

Vibration and temperature measurement tests were conducted on a production UH-1H helicopter to define the vibration and temperature environment for instruments, avionics, pilot station, and other component parts during firing and nonfiring flight. Testing was performed by the United States Army Aviation Systems Test Activity, Edwards Air Force Base, California, between 24 March and 16 June 1972. The testing consisted of 19 flights totaling 20 productive testing hours. Vibration data were recorded from 49 accelerometer locations for 55 flight conditions, and narrow-band spectral analyses were performed on the vibration data. The results of the spectral analyses were summarized by use of statistical methods. The primary source of low-frequency vibrations was the main rotor. Gunfire-induced vibrations were less than main rotor-induced vibrations. The highest vibration levels were recorded at the 42-degree gearbox at gear mesh frequencies. There were three shortcomings: amplification of main rotor-induced vibrations by avionics vibration isolation mounts, pilot station vibrations in excess of the military specification limits, and excessively high Wet Bulb Globe Temperature index at the pilot station under certain environmental conditions.



FOREWORD

The United States Army Air Mobility Research and Development Laboratory, Eustis Directorate, Fort Eustis, Virginia, provided data reduction technical support through a contract with Northrop Corporation, Electronics Division, Palos Verdes Peninsula, California. The United States Army Air Mobility Research and Development Laboratory also provided instrumentation installation, calibration, and maintenance support. The dental work required to construct the pilot's bite block was provided by the Air Force Flight Test Center Dental Laboratory, Edwards Air Force Base, California. Wet Bulb Globe Temperature measurement equipment was obtained from the United States Army Medical Equipment Research and Development Laboratory, Fort Totten, New York. Technical advice on the measurement of pilot vibrations was obtained from the United States Army Aeromedical Research Laboratory, Fort Rucker, Alabama.

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INTRODUCTION

BACKGROUND

1. The failure rates of helicopter components such as instruments, avionics, gearboxes, bearings, pumps, etc., have reduced mission accomplishment and have increased the logistic support effort required to keep Army helicopters at the necessary level of operational capability. It is suspected that many component failures result from an excessive vibration and temperature environment and that the helicopter vibration and temperature environment may degrade pilot performance. However, there are insufficient data available to verify these suspicions. To obtain the data necessary to define the vibration and temperature environment of helicopter components and the pilot station, the United States Army Aviation Systems Test Activity (USAASTA) was directed (ref 1, app A) by the United States Army Aviation Systems Command (AVSCOM) to conduct a vibration and temperature survey on present-day Army helicopters.

2. This report on the UH-1H helicopter is the second of a planned series of seven reports which will define the vibration and temperature environment of the OH-58A (ref 2, app A), UH-1H, CH-54B, OH-6A, CH-47C, AH-1G, and UH-1C helicopters.

TEST OBJECTIVE

3. The objective of the entire environmental test project is to determine a representative vibration and temperature environment for all present-day Army helicopters. The objective of the UH-1H environmental survey was to determine the vibration and temperature environment of the UH-1H instruments, avionics, selected components, and the pilot station under all normal operating conditions.

DESCRIPTION

4. The UH-1H is a gas turbine-powered utility helicopter with a maximum gross weight of 9500 pounds. The single main rotor is of the two-bladed, semirigid, teetering type. The tail rotor is also of the two-bladed, semirigid, teetering type with delta-three coupling. The cockpit provides side-by-side seating for a crew of two (pilot and copilot) and the aft compartment has provisions for up to 11 passengers or cargo. The cyclic, collective, and pedal controls are hydraulically boosted and irreversible. The main landing gear is of the fixed, energy-absorbing skid type and the helicopter is powered by a single Lycoming T53-L-13 free gas turbine engine rated at 1400 shaft horsepower (shp) at sea-level, standard-day, uninstalled conditions. The engine is derated to 1100 shp due to the maximum torque limit of the main transmission. The helicopter may be armed with the M23 armament subsystem (two flexible door-mounted 7.62mm M60D machine guns)

or the XM59 armament subsystem (one flexible door-mounted 7.62mm M60D machine gun and one flexible door-mounted 50-caliber AN-M2 machine gun). The approximate rate of fire of the M60D machine gun is 500 rounds per minute and the approximate rate of fire of the AN-M2 machine gun is 700 rounds per minute. The instruments are rigidly mounted to the fuselage. Selected avionics items are mounted on vibration isolators. Detailed aircraft, flight instruments, and avionics information may be found in appendix B and in the operator's manual (ref 3, app A).

SCOPE OF TEST

5. Vibration data were recorded during steady flight, maneuvering flight, and weapons-firing flight from 43 triaxial accelerometer locations, 5 biaxial accelerometer locations, and 1 uniaxial accelerometer location for 55 flight conditions. Three configurations were tested: light weight, 7000 pounds; heavy weight, 9000 pounds; armed, M23 armament subsystem. For the heavy-weight configuration, ballast was distributed to simulate a troop loading. The flight conditions and configurations tested are listed in table 1 and appendix C, respectively. Temperature data were recorded at 20 locations in flight and during static hot soaks in the sun. The nose of the helicopter was pointed toward the sun for all temperature measurements. The accelerometer and thermocouple locations are described in appendix D and photographs of these locations are presented in appendix E. A total of 19 flights were conducted, consisting of 20 productive testing hours, at Edwards Air Force Base, California. A comparison with selected OH-58A vibration data was made. The flight restrictions and operating limitations observed during this evaluation were as specified in the operator's manual (ref 3, app A). The flight conditions and configurations which will be used for future helicopter environmental testing are contained in the test plan (ref 4).

METHODS OF TEST

6. The test UH-1H helicopter (S/N 67-17145) was instrumented to record vibration data on a frequency multiplexed-frequency modulated (FM-FM) magnetic tape system. One hundred forty channels of acceleration vibration data were recorded from accelerometers mounted on the instrument panel, avionics, pilot station, and other selected components. The instrumentation was limited to recording data from 12 accelerometers simultaneously with eight manual switching groups. This switching enabled a total of 96 channels of vibration data to be recorded for each flight condition by repeating each flight condition seven times. To record the total of 140 channels, the accelerometers were relocated and all flight conditions were repeated eight more times. Twenty channels of temperature data were hand-recorded from a single temperature display by manually switching to the desired temperature pickup. The parameters required to define the flight condition were hand-recorded from calibrated ship's standard instruments.

Table 1. UH-1H Vibration Test Conditions.[1]

Test	Conditions	Average Gross Weight (lb)	Configuration	Average Density Altitude (ft)	Average Temperature (~ °C)
Hover	In ground effect, out of ground effect	7000 and 9000	Clean (doors closed)	3300	18
Level flight	V_H (122 KCAS)[2], $0.9V_H$, $0.8V_H$, $0.7V_H$, V_{loiter} (60 KCAS); 7000-lb GW			5000	11
	V_H (102 KCAS), $0.9V_H$, $0.8V_H$, $0.7V_H$, V_{loiter} (60 KCAS); 9000-lb GW				
Climb	$V_{best\ R/C}$ (55 KCAS), 7000-lb GW; $V_{best\ R/C}$ (60 KCAS), 9000-lb GW; maximum power			5000	11
	$V_{cruise\ R/C}$ (80 KCAS), 7000-lb and 9000-lb GW, maximum power				
Descent	$V_{min\ R/D}$ (49 KCAS), 7000-lb GW; $V_{min\ R/D}$ (55 KCAS), 9000-lb GW; minimum power			5000	11
	$V_{cruise\ R/D}$ (80 KCAS), 500 ft/min				
Takeoff (T/O)	Normal (A), level acceleration (B); from 3-ft hover			3300	15
Landing (LDG)	Normal (A), steep (B), shallow (C); to 3-ft hover			3300	15
Maneuvering flight	90° turns at constant altitude; 15°, 30°, and 45° bank angle, right and left; 100 KCAS entry airspeed			5000	12
Ground run	Flight idle (324 rpm), ground idle (220 rpm), wind speed 15 to 20 knots			2700	14
Weapons firing	Right gun fwd, mid, aft; left gun fwd, mid, aft; both guns fwd, mid, aft; 80 KCAS	8100	Armed (doors open) M23 armament subsystem	4700	17

[1]Coordinated flight maintained at level flight, climb, descent, and maneuvering flight test conditions.
[2]Knots calibrated airspeed.

7. A total of 7837 vibration data records were recorded and narrow-band spectral analyses were performed on 7544 of these data records. To present the results of the spectral analysis in a form which could be more easily comprehended than the 7544 spectral analysis plots, a statistical method of summarizing the data on a digital computer (referred to as data compression) was developed. The data were compressed by selecting groups of the 7544 spectral analysis plots and summarizing each of these groups in two compressed data plots. These two compressed data plots show the maximum acceleration and the mean plus 3-standard-deviation (3-sigma) acceleration with the mean acceleration in the form of a frequency spectrum similar to the individual spectral analysis plots. The mean plus 3-sigma acceleration value is that acceleration below which 99.87 percent of all data recorded fell. Data compression was accomplished by taking the acceleration value at each of the 500 frequencies which were output by the spectral analyzer for all spectral analysis plots in a compression group and finding the maximum and minimum acceleration, the mean acceleration, and the mean plus 3-sigma acceleration. With the data compression plots which present the maximum acceleration values, a table is provided which lists the flight condition, accelerometer location, and axis at which each maximum acceleration occurred. The equations used to calculate the mean and standard deviation and a block diagram of the spectral analysis and data compression systems are presented in appendix F.

8. The flight conditions selected for the vibration testing were intended to cover all normal flight conditions encountered in operational use of the UH-1H helicopter. The first pass of the data compression grouped the data according to flight condition. The second and third data compression passes combined all of the flight conditions in proportion to the number of columns each flight condition occupies in the data array (figs. 1 through 3, app G). For example, landings comprise 6 out of 46 nonfiring columns or 13 percent of the data which, in the compressions that combine flight conditions, represents a flight during which 13 percent of the flight time is spent in landings. The first-pass data compressions may be used to combine flight conditions in any proportion desired.

CHRONOLOGY

9. The chronology of testing was as follows:

Test request received	14 September	1970
Test aircraft available	12 January	1972
Test flying initiated	24 March	1972
Test flying completed	9 June	1972

RESULTS AND DISCUSSIONS

GENERAL

10. The UH-1H instruments and avionics nonfiring vibrations were found to be primarily sinusoidal with a random variation of amplitude with time at each discrete frequency at steady flight conditions. The primary source of low-frequency vibrations was the main rotor, with a maximum mean plus 3-standard-deviation (3-sigma) vibration acceleration value of 0.94g at the main rotor six-per-rotor-revolution (6/rev) frequency of 32.4 hertz (Hz). Instruments and avionics vibrations during firing were primarily broadband with little discrete frequency content. Gunfire-induced vibrations were less than main rotor-induced vibrations with a maximum mean plus 3-sigma vibration acceleration value of 0.24g at 466 Hz. The pilot seat pad did not attenuate vibrations in the frequency range of main rotor-induced vibrations; however, the pilot's body attenuated vibrations above 10 Hz. Pilot station vibrations were more objectionable at 7.3 Hz (main rotor 2/rev frequency at ground idle) than at 32.4 Hz at equal amplitudes and exceeded the limits of military specification MIL-H-8501A. Instrument and avionics vibration levels were well below the laboratory qualification vibration levels of MIL-STD-810B. The main rotor-induced vibrations in the OH-58A and UH-1H helicopters reached their highest levels at the main rotor 4/rev and 6/rev frequencies in both helicopters. However, the magnitude of the UH-1H main rotor-induced vibrations was about twice that of the OH-58A main rotor-induced vibrations. The maximum mean plus 3-sigma vibration acceleration level for all locations tested was 44g at 1920 Hz at the 42-degree gearbox. The highest instrument and avionics temperatures were recorded in the forward cabin area under static conditions and decreased in forward flight. Under certain environmental conditions, the Wet Bulb Globe Temperature (WBGT) index is excessively high at the pilot station. The results of this test project indicate the following: Data in this and previous environmental test reports could be applied to revising the appropriate military environmental specifications; improved vibration isolation methods should be developed; consideration should be given to specifying the pilot station vibration limits in MIL-H-8501A as a function of frequency below 32 Hz; consideration should be given to use of a seat cushion to attenuate main rotor vibrations; and consideration should be given to installing an environmental control system for use in extreme environmental conditions.

VIBRATION DATA

Data Relevancy

11. Qualitative pilot evaluation indicates that there is a wide variation in the vibration level of different helicopters of the same model due to differences in the mechanical condition of each helicopter. Thus, if vibration levels are to be measured which are representative of those encountered in a particular model of

helicopter, then a sample of several units of this model of helicopter must be tested. All of the data in this report are from one UH-1H helicopter, S/N 67-17145, which was obtained from Bell Helicopter Company (BHC) by USAASTA with 530 flight hours and accumulated 120 additional flight hours at USAASTA before this vibration test was conducted. It is not known what the vibration level of a UH-1H with a similar number of hours in hard operational use would be; however, it is probable that there are UH-1H helicopters with higher vibration levels than the helicopter tested.

Data Presentation

12. The data were summarized in three data compression passes and in 8 transmissibility compressions. Each data compression is presented as two plots: maximum acceleration recorded versus frequency, and mean with mean plus 3-sigma acceleration versus frequency. The mean plus 3-sigma acceleration values are felt to best represent the test data, since accelerations in excess of the mean plus 3-sigma limit were recorded less than 0.13 percent of the time. This result indicates that accelerations in excess of the mean plus 3-sigma limit would be only rarely encountered in operational use of the helicopter. The data grouping used in each compression pass is summarized in table 2, with details of the data compression shown in the data arrays - figures 1, 2, and 3, appendix G. In the data array, each square represents a spectral analysis data point. The numbers assigned to each group of squares in the data array represent a compression group, with squares with like numbers belonging to the same compression group. This compression group number is written on each compressed data plot for identification. The transmissibility compressions combine all axes and nonfiring flight conditions for the input and output accelerometer locations of interest. The specific locations compressed are indicated on each transmissibility plot.

13. The instrument and avionics nonfiring third-pass compression results are presented in table 3 and in figures A and B in the body of this report. The instruments and avionics third-pass firing compression results are presented in figures 40 and 41, appendix G. The second-pass nonfiring compressions and the first-pass firing compressions are presented in appendix G for all accelerometer locations. Only the instruments, avionics, and pilot station compressions are presented in appendix G for the first-pass nonfiring conditions. The first-pass compressions for the other locations are available from USAASTA. For the first-pass firing and second and third compression passes nonfiring, a table is presented with the plot of the maximum accelerations which lists the accelerometer location, axes, and flight condition at which each significant peak occurred. For the nonfiring third-pass compression, this table is expanded to include the source of the significant accelerations. The acceleration values which are presented in this report are one-half of the peak-to-peak value. The individual spectral analysis data, on digital magnetic tape, are available from USAASTA.

Table 2. Data Compression Grouping.

Compression Pass	Group[1]	Group Elements (location number)	Number of Group Elements	Number of Compressions
1st	Equipment	Instrument panel (1, 2, 3, 4, 5) Avionics equipment (6, 7, 8, 9, 10) Pilot input (11, 12, 13, 14, 15) Pilot output (16, 17) Transmission mounts (18, 19, 20, 21) Tail boom attach points (22, 23) Engine deck (24, 25) Engine firewall (26, 27) Engine mounts (28, 29, 44) Tail rotor servo (30) Oil cooler (31) 42° and 90° gearboxes (32, 33) Hydraulic servo (34) Fuel boost pumps (35, 45) Tach generators (36, 37, 38) Hanger bearings (39, 40, 41, 42) Engine (46, 47, 48) Lift link (43) Gun mount[2] (49)	19	145
	Flight conditions[3]	Hover Level flight Climb Descent Takeoff and landing Turns Ground run Weapons firing[2]	8	
2nd	Equipment	Same as 1st pass with gun mount omitted	18	18
	Flight conditions	All nonfiring	1	
3rd	Equipment	Instruments and avionics (1, 2, 3, 4, 5, 6, 7, 8, 9, 10)	1	2
	Flight conditions	Nonfiring Weapons firing	2	

[1]All axes combined for all compressions.
[2]Gun mount data presented only for weapons firing.
[3]Flight conditions are described in detail in table 1.

Table 3. UH-1H Vibration Sources.

Main rotor speed: 324 rpm		
Source		Frequency (Hz)
Main rotor	Fundamental	5.4
	2/rev	10.8
	4/rev	21.6
	6/rev	32.4
	8/rev	43.2
	10/rev	54.0
	12/rev	64.8
	14/rev	75.6
Tail rotor	Fundamental	27.6
	2/rev	55.1
	4/rev	110.2
	6/rev	165.3
	8/rev	220.4
	10/rev	275.5
Engine shaft	Fundamental	110
Tail rotor drive shaft		72
Gas producer (100%)		419
Power turbine		351
90-degree gearbox gear mesh		1072
42-degree gearbox gear mesh		1930
Main transmission, second stage		640
Main transmission lower section, drive bevel gear		1857
Main transmission, first stage		1977
Gunfire at 550 rounds/minute	Fundamental	9.2
	1st harmonic	18.3
	2nd harmonic	27.5
	3rd harmonic	36.7
	4th harmonic	45.8
	5th harmonic	55.0
	6th harmonic	64.2
	7th harmonic	73.3
	8th harmonic	82.5
	9th harmonic	91.7
	10th harmonic	100.8

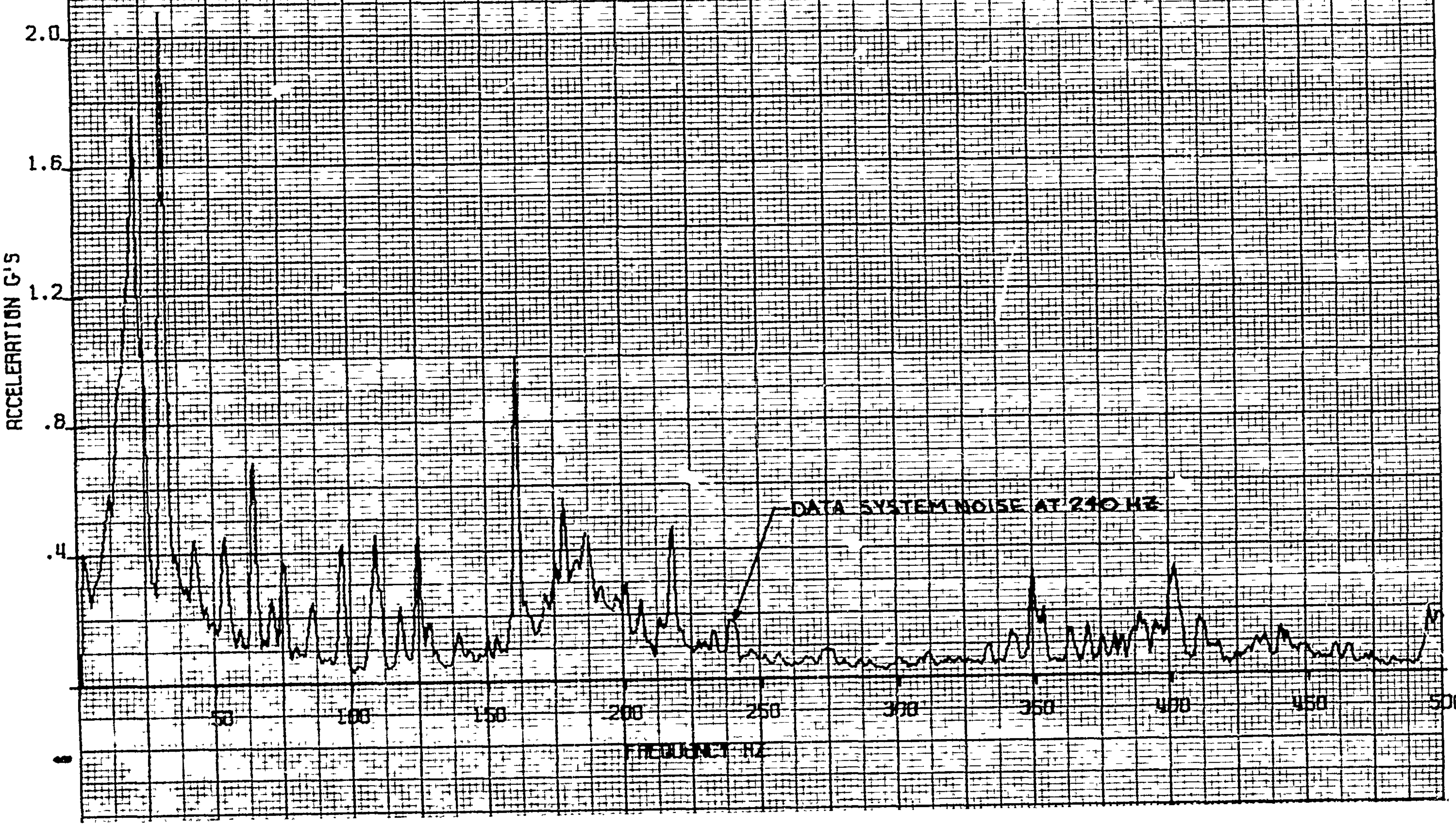
FIG A

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000LB AVG CG STA-MID CMBO CONFIG

ALL FLT CONDS INSTR PANEL AND AVIONICS COMPT CMBO AXIS VIB COMPRESSION 436



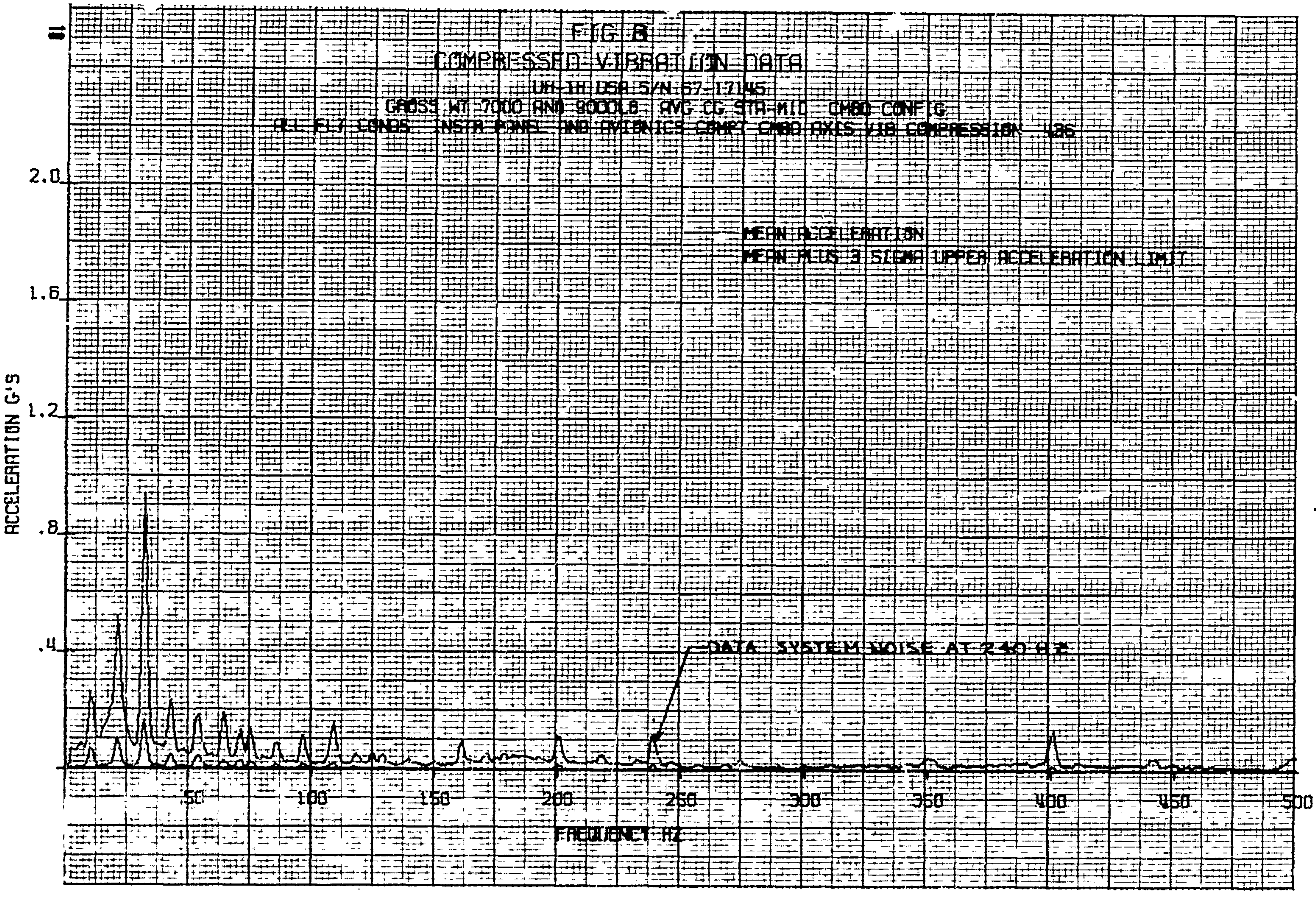


FIG 8
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CMBD CONFIG
ALL FLT CONDS INSTR PANEL AND AVIONICS COMPT CMBD AXIS VIB COMPRESSION 436
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE AT 240 HZ
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

Instruments and Avionics Vibration

14. Instruments and avionics vibration data were gathered from ten triaxial accelerometer locations at the test conditions shown in table 1. Accelerometer locations are described in detail in table 2, appendix D, and shown in photographs in appendix E. The third-pass data compressions are presented in figures A and B in the body of this report and in figures 40 and 41, appendix G. Second-pass data compressions are presented in figures 4 through 7, appendix G, and first-pass data compressions are presented in figures 80 through 107, appendix G. The data were found to be primarily sinusoidal with a random variation of acceleration amplitude with time at each discrete frequency at steady flight conditions. The random amplitude variation was usually less than 20 to 30 percent of the acceleration amplitude mean value and was apparently due to small changes in variables such as light turbulence or small control inputs. The main rotor was the primary nonfiring vibration source, with the tail rotor, tail rotor drive shaft, and engine also causing significant vibrations. Table 3 lists the primary UH-1H vibration sources and their frequency. A maximum mean plus 3-sigma acceleration value of 0.94g at the main rotor 6/rev frequency of 32.4 Hz was recorded. A peak acceleration value of 2.08g at the main rotor 6/rev frequency was recorded along the longitudinal axis on the lower left portion of the instrument panel (location 2) during a 45-degree bank left turn. Table 4 lists the frequency, flight condition, axis, location, and source of the maximum nonfiring accelerations presented in figure A. A general discussion of helicopter vibration sources is contained in appendix H.

15. The instruments and avionics firing vibration data were broadband with little discrete frequency content. The gunfire-induced vibration levels were lower in amplitude than the nonfiring vibration levels, while the peak amplitudes occurred at higher frequencies. Vibrations at the gunfire fundamental frequency of 9.2 Hz or harmonics of this frequency were not observed. These low-frequency gunfire vibrations may have been concealed by main rotor-induced vibrations which are of similar frequencies. A maximum mean plus 3-sigma gunfire acceleration value of 0.24g at a frequency of 466 Hz was recorded. A peak acceleration value of 0.65g at 209 Hz was recorded along the longitudinal axis in the center of the instrument panel (location 3) with the right door gun firing forward. The majority of the peak accelerations recorded on the forward-mounted instruments and avionics occurred with the door guns firing forward, indicating that the muzzle blast was a significant cause of vibration.

Comparison with the Military Standard

16. Figure C shows a laboratory vibration test curve for equipment installed in helicopters taken from figure 514.1-3 of the military standard, MIL-STD-810B (ref 5, app A). The ordinate is changed from units of vibration amplitude as the curve is presented in MIL-STD-810B to units of vibration acceleration to be compatible with the data presented in this report. The significant mean plus 3-sigma acceleration limits from figure B and figure 40, appendix G, are plotted on this specification curve with previously acquired OH-58A vibration data (ref 2). This

Table 4. Instruments and Avionics Maximum Accelerations for Figure A (Nonfiring).

Frequency (Hz)	Flight Condition[1]	Gross Weight (lb)	Axis[2]	Location Number	Amplitude (~ g)	Source
12	LDG B	7000	V	4	0.59	Main rotor 2/rev
22	LDG B	7000	V	5	1.76	Main rotor 4/rev
32	LT 45°	7000	H	2	2.08	Main rotor 6/rev
43	LDG C	7000	V	6	0.45	Main rotor 8/rev
54	LF (V_H)	7000	H	5	0.46	Main rotor 10/rev Tail rotor 2/rev
65	LDG C	7000	H	2	0.68	Main rotor 12/rev
72	LDG B	9000	H	4	0.26	Tail rotor drive shaft
76	LDG C	7000	H	5	0.38	Main rotor 14/rev
86	LDG A	7000	H	5	0.25	Main rotor 16/rev
97	LT 45°	7000	H	2	0.43	Main rotor 18/rev
109	T/O B	9000	V	8	0.46	Main rotor 20 rev Tail rotor 4/rev Engine shaft
125	V_{min} R/D	7000	V	7	0.45	--
161	V_{cruise} R/D	7000	V	7	1.00	--
178	V_{min} R/D	7000	V	7	0.56	--
186	V_{cruise} R/D	7000	V	7	0.45	--
218	V_{min} R/D	7000	V	7	0.47	--
349	V_{min} R/D	9000	V	8	0.33	Power turbine
401	OGE Hover	7000	V	7	0.34	Gas producer

[1]Flight condition abbreviations defined in table 1.
[2]V: vertical.
H: longitudinal.

specification curve does not limit helicopter instrument and avionics vibration levels but gives vibration levels to be used for laboratory qualification of instruments and avionics for helicopter use. A data compression composed of only equipment mounted on isolators was not calculated, since the lower curve of figure C assumes that the vibration isolators will reduce vibrations above a frequency of 33 Hz, which was not the case for the vibration isolators tested. All instruments and avionics mean plus 3-sigma vibration levels are well below the test curve of MIL-STD-810B.

Isolation Mount Characteristics

17. The transmissibility of the isolation mounts on the RT-348/ARC-54 radio and MD-1 vertical gyro was evaluated at the UH-1H driving frequencies. Transmissibility was determined by measuring the input and output accelerations across the isolation mounts and calculating the ratio of output to input acceleration. The input and output accelerations used were those determined from the mean plus 3-sigma compressions of all axes and all nonfiring flight conditions. This ratio is plotted as a data point at each driving frequency in figure D. The results indicate that the isolation mounts significantly amplify UH-1H driving frequencies between 30 Hz and 110 Hz for the RT-348/ARC-54 radio and below 100 Hz for the MD-1 vertical gyro. This amplification is apparently due to isolator resonant frequencies which are near the helicopter driving frequencies. Outside these frequency ranges the isolators were effective in isolating vibration. Several maximum accelerations at particular driving frequencies were recorded on these two isolated items, as shown in figures 7 and 45, appendix G. The amplification of vibrations in this low-frequency range is highly undesirable, since the severest UH-1H instrument and avionics vibrations occur at these low frequencies. Amplification by the vibration isolators is a shortcoming, correction of which is desirable.

Pilot Station Vibrations

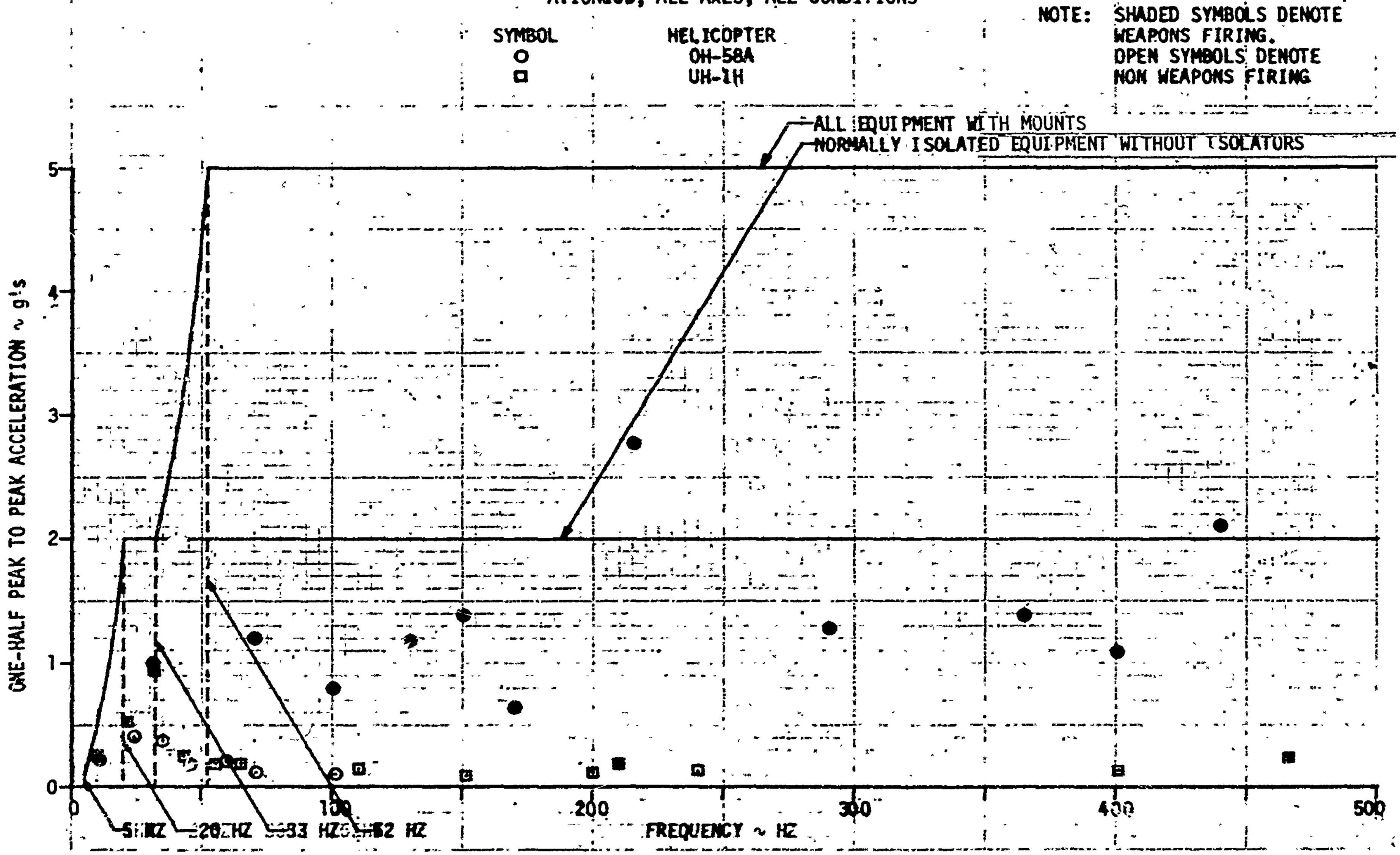
18. Pilot station vibrations were measured at the pilot collective grip, cyclic grip, right foot rest, seat structure, seat pad, bite block, and helmet at the conditions shown in table 1. Accelerometer locations are described in detail in table 2, appendix D, and are shown in photographs in appendix E. The second-pass data compressions are presented in figures 8 through 11, appendix G, and the first-pass data compressions are presented in figures 108 through 135. The pilot for which this data were recorded weighed 160 pounds and was 68 inches tall. Forty pounds of ballast was placed on the floor beneath the pilot seat to simulate a 200-pound pilot station loading.

19. The transmissibility of the seat pad was evaluated by calculating the ratio of the seat pad acceleration to the seat structure accelerations at UH-1H driving frequencies. These ratios are plotted in figure E. Seat pad acceleration was measured by attaching an accelerometer to the bottom of a 10-inch by 6-inch by 0.020-inch aluminum plate on which the pilot sat. The accelerations used were those determined from the mean plus 3-sigma compressions of all axes and all nonfiring flight conditions for the seat pad and seat structure. Results indicate that there

FIGURE C

LABORATORY VIBRATION TEST CURVES FOR EQUIPMENT INSTALLED IN HELICOPTERS
FROM MIL-STD-810B, FIG 514.1-3

MEAN PLUS 3 SIGMA ACCELERATION, ALL INSTRUMENTS AND AVIONICS, ALL AXES, ALL CONDITIONS



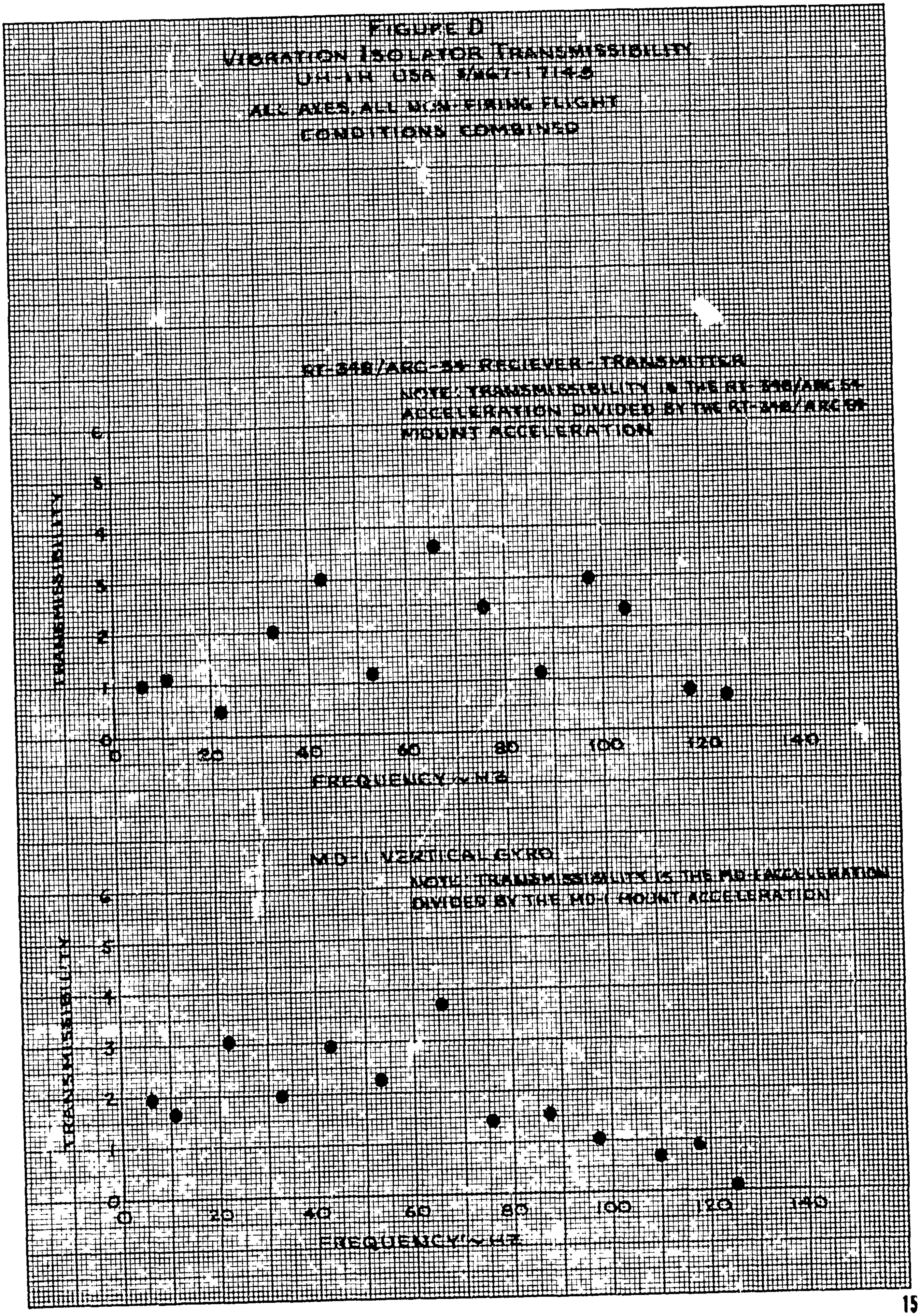


FIGURE D
VIBRATION ISOLATOR TRANSMISSIBILITY
UH-1H USA S/N67-17145
ALL AXES, ALL NON-FIRING FLIGHT
CONDITIONS COMBINED
RT-348/ARC-54 RECIEVER-TRANSMITTER
NOTE: TRANSMISSIBILITY IS THE RT-348/ARC-54 ACCELERATION DIVIDED BY THE RT-348/ARC-54 MOUNT ACCELERATION
TRANSMISSIBILITY
0
1
2
3
4
5
6
0
20
40
60
80
100
120
140
FREQUENCY ~ HZ
MD-1 VERTICAL GYRO
NOTE: TRANSMISSIBILITY IS THE MD-1 ACCELERATION DIVIDED BY THE MD-1 MOUNT ACCELERATION
TRANSMISSIBILITY
0
1
2
3
4
5
6
0
20
40
60
80
100
120
140
FREQUENCY ~ HZ

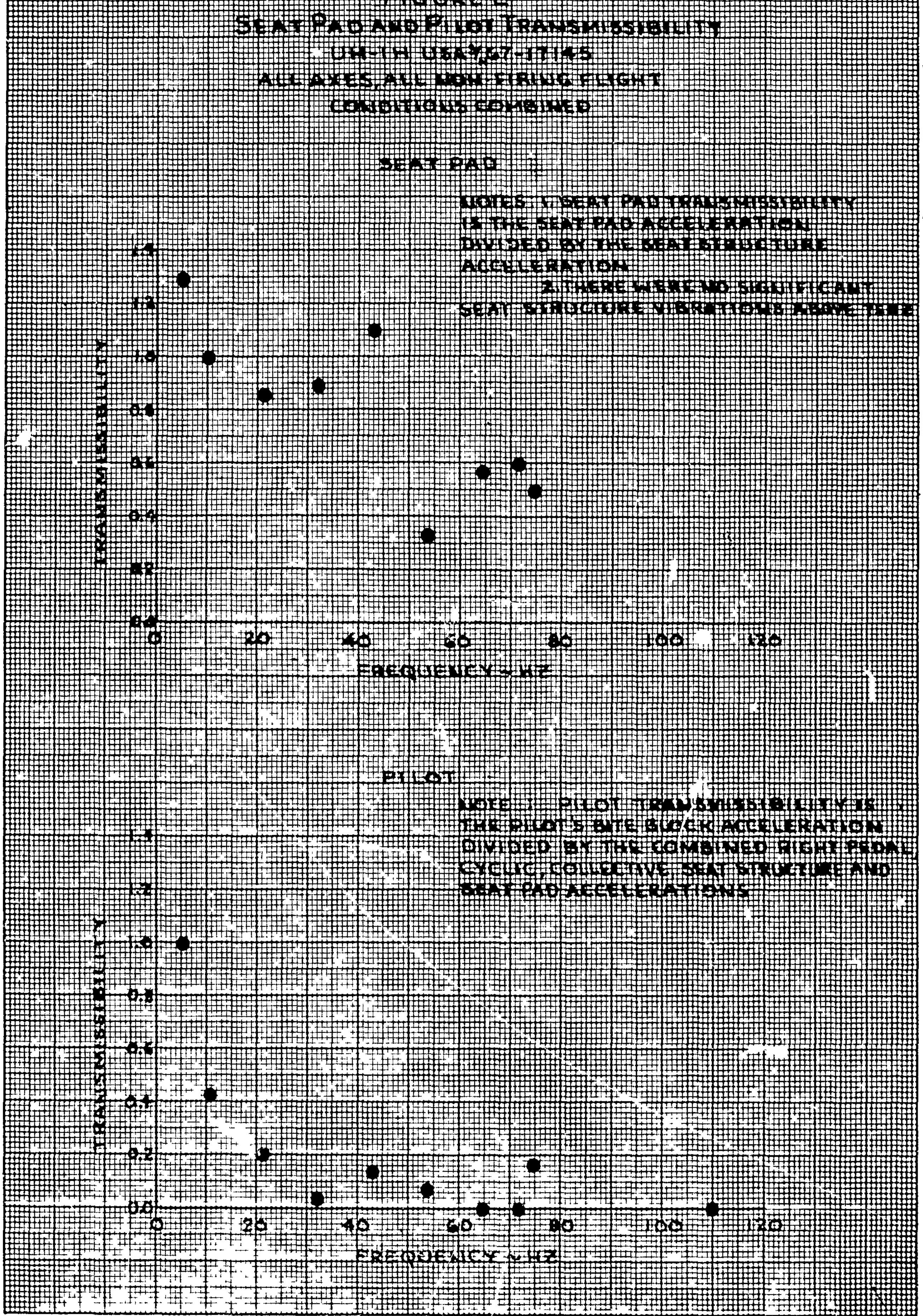


FIGURE E
SEAT PAD AND PILOT TRANSMISSIBILITY
UH-1H USA 67-17145
ALL AXES, ALL NON-FIRING FLIGHT CONDITIONS COMBINED

is no attenuation of seat structure vibrations by the seat pad below 45 Hz. Since the primary main rotor-induced vibrations are below 45 Hz, it is likely that a significant reduction in vibrations transmitted to the pilot could be achieved with a seat pad which attenuated low-frequency vibrations.

20. The pilot's head vibrations were measured with an accelerometer attached to a bite block. The bite block was a plastic and aluminum form shaped to fit the pilot's teeth which the pilot held securely in his mouth when vibrations were recorded from this location. The ratio of the bite block acceleration to the combined collective grip, cyclic grip, right foot rest, seat structure, and seat pad accelerations was calculated and is presented as pilot transmissibility in figure F. The results show that the pilot's body attenuates vibrations above 10 Hz.

21. The pilot station vibration limits of paragraph 3.7.1b of MIL-H-8501A (ref 5, app A) are compared to the seat structure and seat pad mean plus 3-sigma accelerations for all axes combined in figure F. The data are divided into two groups: hover, level flight, climb, and descent compose one group; while takeoff, landing, and turns compose the other group. There is no specification limit on vibration levels during maneuvering flight, so these data were combined with the takeoff and landing transition data, since most maneuvers are transient conditions. There is a specification vibration limit for flight from V_{cruise} to V_{limit} airspeeds but no data were grouped for this condition, since the V_{cruise} and V_{limit} airspeeds are identical for the UH-1H helicopter. The results show that the main rotor 2/rev acceleration slightly exceeded the cruise flight limit of 0.15g and the main rotor 6/rev acceleration exceeded the transition flight limit of 0.3g at this frequency. Vibration levels at the pilot station in excess of the limits of MIL-H-8501A are a shortcoming, correction of which is desirable.

22. In addition to this combined test condition data, a bite block mean plus 3-sigma acceleration of 0.32g at 7.3 Hz (fig. 134, app G) was recorded for the ground-idle test condition. This test was conducted in a 15- to 20-knot wind at a main rotor speed of 220 rpm. The wind and low rotor speed excited a helicopter structural mode which produced high-amplitude low-frequency vibrations at the pilot station. This low-frequency vibration was qualitatively judged to be tolerable only for short periods of time. In contrast, the 32.4-Hz (6/rev) combined test condition seat pad vibration of 0.50g was not noticeable to the pilot. This result is indicated in figure D, which shows that vibrations at 32.4 Hz are almost completely attenuated by the pilot's body while those at 7.3 Hz are not attenuated. MIL-H-8501A specifies constant acceleration limits from zero frequency to 32 Hz. The results of this test indicate that specification acceleration levels should decrease with frequency.

FIGURE F

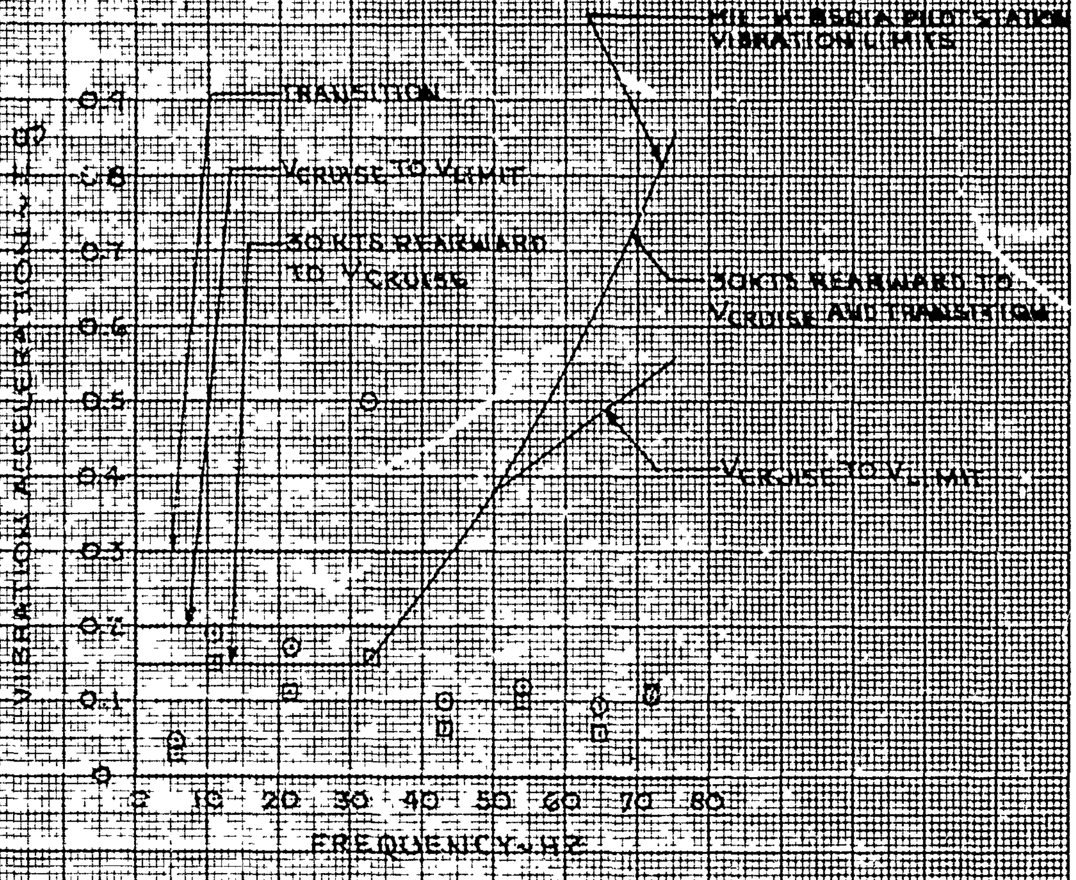
COMPARISON WITH MIL-H-8501A CREW STATION VIBRATION LIMITS

UH-1H USA S/N 67-17145

ALL AXES

MEAN PLUS 3-SIGMA ACCELERATION

SYMBOL	FLIGHT CONDITION
○	TAKEOFF-LANDING-TURNS
□	HOVER-LEVEL FLIGHT-CLIMB-DESCENT



Selected Component Vibration Characteristics

23. Vibration data were recorded at 32 locations throughout the helicopter, other than instruments, avionics, and the pilot station. These locations are described in table 2 and appendix D and shown in photographs in appendix E. Data were recorded at the request of the United States Army Air Mobility Research and Development Laboratory (USAAMRDL), Eustis Directorate, and were transmitted to USAAMRDL in the Northrop Corporation data report (ref 7, app A). The selected component second-pass nonfiring data and first-pass firing data are presented in this report in figures 12 through 39 and figures 50 through 79, appendix G, respectively. The selected component first-pass nonfiring data are not presented in this report but are available from USAASTA.

24. The vibration characteristics at these locations will not be discussed in detail but in general show the presence of high-level, high-frequency vibration near rotating equipment, particularly gearboxes. The maximum mean plus 3-sigma vibration acceleration level recorded for all locations was 44g at 1920 Hz at the 42-degree tail rotor gearbox (fig. 26, app G).

Comparison with OH-58A Test Data

25. Vibration data gathered from the OH-58A helicopter (ref 2, app A) are compared with the UH-1H helicopter vibration data in figure C. The nonfiring data are similar for both helicopters. Both helicopters have two-bladed rotors of similar design and the main rotor driving frequencies are nearly alike. The highest vibration levels occurred in both helicopters at the 4/rev and 6/rev frequencies. However, the amplitude of the UH-1H main rotor-induced vibrations was about twice that of the OH-58A main rotor-induced vibrations. The weapons firing vibrations of the UH-1H with the M23 armament subsystem were markedly different from those of the OH-58A with the M27E1 armament subsystem. The UH-1H weapons vibrations were broadband with little discrete frequency content, while the OH-58A weapons firing vibrations were harmonic with a high discrete frequency content. The amplitude of the UH-1H weapons firing vibrations was only about one-tenth that of the OH-58A vibrations. The lack of harmonic frequency content and large reduction in vibration amplitude was not expected, since identical ammunition was fired from each helicopter. The M23 armament subsystem (UH-1H) uses two M60D gas-driven machine guns firing 7.62mm ammunition at about 9 rounds per second from each gun. The M23E1 armament subsystem uses one M134 electrically-driven machine gun firing 7.62mm ammunition at about 33 or 66 rounds per second.

TEMPERATURE DATA

Component Air Temperatures

26. Component part surrounding air temperatures were recorded at 20 locations, as described in table 3, appendix D, and shown in photographs in appendix E.

Temperatures were recorded for static hot soaks in the sun, level flight between 57 and 99 KCAS, and in-ground-effect (IGE) and out-of-ground-effect (OGE) hover. The helicopter was headed toward the sun for all temperature measurements. All vents and the pilot and copilot windows were open for in-flight temperature measurements. Tempe atures were recorded with the vents, windows, and doors open and closed for static temperature measuiements. Temperature data for all conditions are presented in table 5. Detailed static temperature data are presented in figures 136 through 144, appendix G, for locations with a temperature rise of 10°C or greater. Temperature rise was determined by subtracting the outside air temperature from the component temperature of interest.

27. It was found that solar radiation had a significant effect on static temperatures but only a small effect on in-flight temperatures. In-flight data were obtained over a range of solar radiation values by recording data at different times of day from morning until afternoon. Less than 10 minutes were required for in-flight temperatures to stabilize at steady-state values. The in-flight temperature data presented in table 5 were obtained by averaging the temperature data over the range of solar radiation values tested. Static temperatures required about 2 hours to stabilize. This long stabilization time required that temperatures be recorded around noon, when solar radiation was nearly constant for a 2-hour period. To determine static temperatures for values of solar radiation and ambient air temperature different than those tested, an analytical method was developed which is described in appendix F. Figures 136 through 144, appendix G, are the results of this analytical method and representative solar radiation values (refs 8 and 9, app A).

28. Static temperature data for the cabin and avionics locations are tabulated at a solar radiation value of 350 BTU/hr-ft^2 and outside air temperature of 45°C in table 5. These results show that the highest temperatures occur in the forward cabin and forward avionics areas under static conditions and decrease in flight. Temperatures in the aft cabin and avionics areas were low under static conditions but increased in flight. The high forward cabin and avionics static temperatures are due to large amounts of transparent area in the forward section of the fuselage, which allow solar radiation to enter. Forward cabin temperatures are lower in flight due to increased air circulation. Aft cabin and avionics temperatures increase in flight due to engine, transmission, hydraulic, and electronic component heat sources. The highest average temperature rise recorded was 81.5°C at the upper engine compartment in an IGE hover.

Wet Bulb Globe Temperature Index

29. The WBGT index (ref 10, app A) was recorded in flight with all doors closed, all vents open, and the pilot and copilot windows open. A sensing unit consisting of a dry bulb thermometer, wet bulb thermometer, and black globe thermometer was located near the pilot in the sun. The sensing unit was obtained from the United States Army Medical Equipment Research and Development Laboratory and is shown in photograph 42, appendix E. Dry bulb and black globe temperatures versus solar radiation and airspeed are presented in figure G.

Table 5. Average Temperature Rise.

UH-1H USA S/N 67-17145

Location Number	Location Name	Average Temperature Rise (~ °C)[1]			
		In-Ground-Effect Hover[2]	Out-of-Ground-Effect Hover[2]	Level Flight[2]	Static[3]
1	Forward avionics	10.0	6.5	8.3	26.0
2	Aft avionics	10.5	11.5	9.9	2.9
3	Forward cabin	3.5	3.5	4.5	30.0
4	Aft cabin	6.0	7.0	14.9	10.0
5	Forward transmission compartment	8.5	18.5	24.3	0.8
6	Aft transmission compartment	8.0	11.0	32.1	3.5
7	Upper engine compartment	81.5	31.5	58.6	19.0
8	Lower engine compartment	51.2	26.0	38.5	5.8
9	42-degree gearbox	33.5	18.5	29.1	10.0
10	90-degree gearbox	0.5	0.5	6.6	3.7
11	Oil cooler	15.5	15.5	11.3	7.7
12	Right fuel boost pump	Zero	1.5	1.3	Zero
13	Left fuel boost pump	8.5	17.5	11.7	Zero
14	No. 1 hanger bearing	64.5	37.5	43.0	12.5
15	No. 2 hanger bearing	58.0	28.0	14.0	18.5
16	No. 3 hanger bearing	33.0	71.5	13.8	28.0
17	No. 4 hanger bearing	39.5	28.0	21.2	26.5
18	N_1 tach generator	59.5	26.5	46.6	8.7
19	N_2 tach generator	67.5	44.5	47.4	7.4
20	Main rotor tach generator	5.5	21.0	26.1	4.1

[1]Average temperature rise calculated by subtracting the outside air temperature from each location temperature.
[2]57 to 99 KCAS. Average solar radiation of 241 BTU/hr-ft^2.
[3]Solar radiation of 350 BTU/hr-ft^2. Outside air temperature of 45°C.

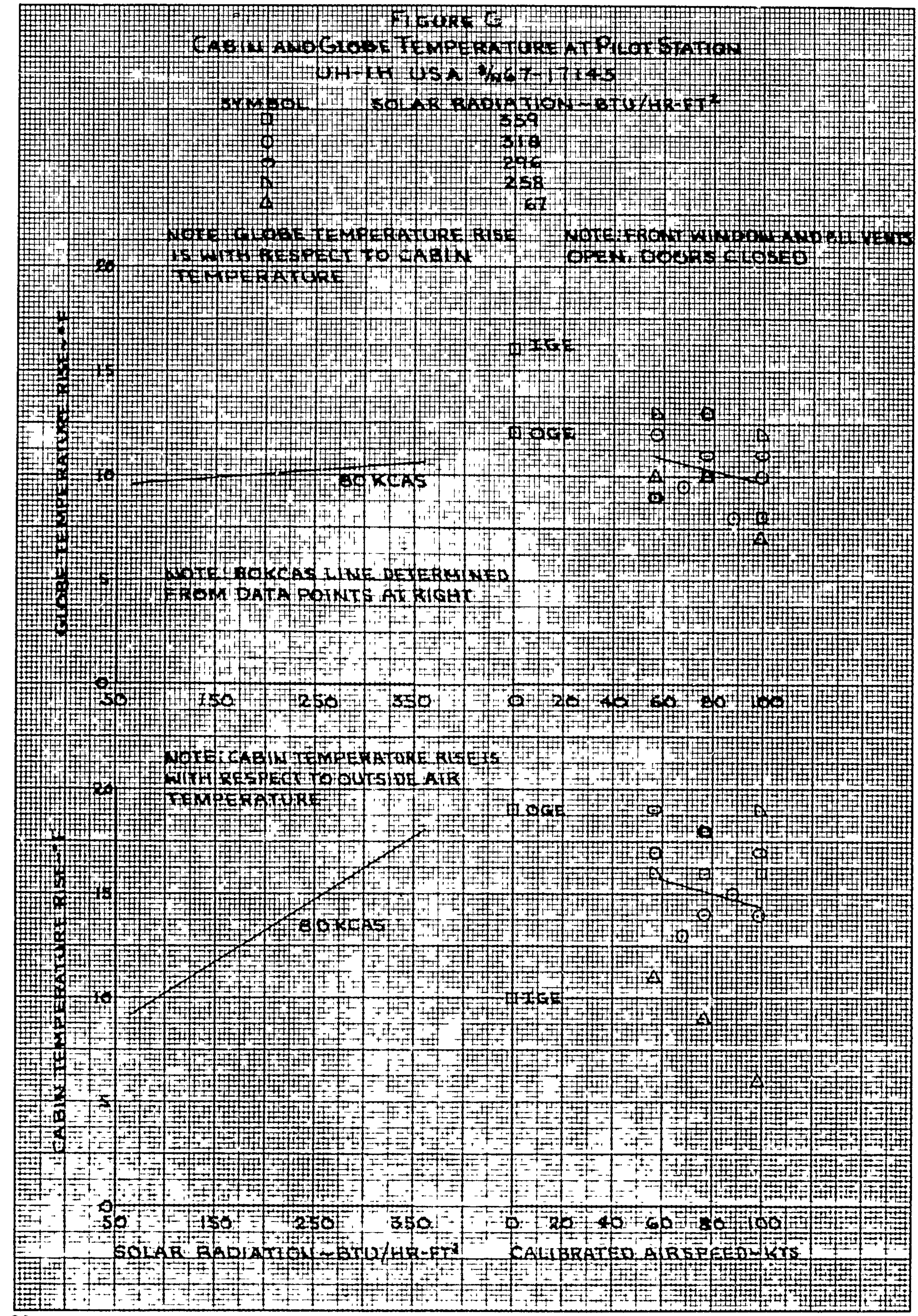


FIGURE G
CABIN AND GLOBE TEMPERATURE AT PILOT STATION
UH-1H USA S/N 67-17145
SYMBOL SOLAR RADIATION ~ BTU/HR-FT²
359
318
296
258
67
NOTE: GLOBE TEMPERATURE RISE IS WITH RESPECT TO CABIN TEMPERATURE
NOTE: FRONT WINDOW AND ALL VENTS OPEN, DOORS CLOSED
IGE
OGE
80 KCAS
NOTE: 80KCAS LINE DETERMINED FROM DATA POINTS AT RIGHT
GLOBE TEMPERATURE RISE ~ °F
NOTE: CABIN TEMPERATURE RISE IS WITH RESPECT TO OUTSIDE AIR TEMPERATURE
CABIN TEMPERATURE RISE ~ °F
SOLAR RADIATION ~ BTU/HR-FT²
CALIBRATED AIRSPEED ~ KTS

30. The WBGT index is used to describe the effect of the temperature environment on the human body. It is determined by adding 70 percent of the naturally convected wet bulb temperature, 20 percent of the black globe temperature, and 10 percent of the dry bulb temperature. Temperatures are in degrees Fahrenheit. The following criteria for application of the WBGT are proposed in Department of the Army Technical Bulletin TB MED 175 (ref 10, app A):

a. When the WBGT Index reaches 82°, discretion should be used in planning heavy exercise for unseasoned personnel.

b. When the WBGT reaches 85°, strenuous exercises, such as marching at standard cadence should be suspended in unseasoned personnel during their first three weeks of training. At this temperature training activities may be continued on a reduced scale after the second week of training.

c. Outdoor classes in the sun should be avoided when the WBGT exceeds 85°.

d. When the WBGT reaches 88°, strenuous exercise should be curtailed for all recruits and other trainees with less than 12 weeks training in hot weather. Hardened personnel, after having been acclimatized each season, can carry on limited activity at WBGT of 88° to 90° for periods not exceeding 6 hours a day.

The highest WBGT value recorded in cruise flight was 81°F at an outside air temperature of 86°F, a relative humidity of 26 percent, and a solar radiation value of 250 BTU/hr-ft^2. Based on the data presented in figure G and a psychrometric chart, the WBGT can be calculated for any combination of outside air temperatures, relative humidity, and solar radiation. For an outside air temperature of 100°F, a relative humidity of 50 percent, and a solar radiation of 250 BTU/hr-ft^2, the WBGT would be 97°F at the pilot station. This calculation is described in appendix F. A WBGT of 97°F is well in excess of the maximum discussed in the above criteria, and it is likely that a WBGT higher than 97°F would be recorded under certain conditions. Excessively high WBGT index at the pilot station under certain environmental conditions is a shortcoming, correction of which is desirable.

CONCLUSIONS

GENERAL

31. Analysis of the test results obtained during this evaluation resulted in the following conclusions:

a. The UH-1H instrument and avionics vibrations are primarily sinusoidal with a random variation of amplitude with time at each frequency at steady flight conditions (para 14).

b. The primary source of low-frequency vibration is the main rotor, with a maximum mean plus 3-sigma acceleration of 0.94g measured at the main rotor 6/rev frequency of 32.4 Hz (para 14).

c. Gunfire-induced vibrations are broadband with little discrete frequency content (para 15).

d. Gunfire-induced vibrations were less than main rotor induced-vibrations, with a maximum mean plus 3-sigma acceleration of 0.24g at 466 Hz (para 15).

e. All instrument and avionics mean plus 3-sigma vibration levels are well below the laboratory test curve of MIL-STD-810B (para 16).

f. The pilot seat pad did not attenuate vibrations below 45 Hz (para 19).

g. The pilot's body attenuates vibrations above 10 Hz (para 20).

h. Pilot station vibrations at 7.3 Hz are more objectionable than those of equal amplitude at 32.4 Hz (para 22).

i. The maximum mean plus 3-sigma vibration level for all locations tested was 44g at 1920 Hz at the 42-degree gearbox (para 24).

j. Main rotor-induced vibration amplitudes in the OH-58A and UH-1H helicopters reach their highest levels at the 4/rev and 6/rev frequencies in both helicopters (para 25).

k. The amplitude of the UH-1H main rotor-induced vibrations is about twice that of the OH-58A main rotor-induced vibrations (para 25).

l. The highest instrument and avionics temperatures were recorded in the forward cabin and forward avionics areas under static conditions and decreased in forward flight (para 28).

m. The highest average temperature rise was 81.5°C above the outside air temperature at the upper engine compartment in an IGE hover (para 28).

n. There were no deficiencies noted during the testing.

SHORTCOMINGS AFFECTING MISSION ACCOMPLISHMENT

32. Correction of the following shortcomings is desirable for improved operation and mission capabilities:

a. Amplification of vibrations at the main rotor driving frequencies by the vibration isolation mounts on the MD-1 vertical gyro and RT-348/ARC 54 radio (para 17).

b. High pilot station vibrations in excess of the limits of paragraph 3.7.1b of MIL-H-8501A (para 21).

c. Excessively high Wet Bulb Globe Temperature index at the pilot station under certain environmental conditions (para 30).

RECOMMENDATIONS

33. The shortcomings should be corrected.

34. The data in this report and subsequent environmental test reports should be applied to revising appropriate military environmental specifications.

35. Improved vibration isolation for instrument and avionics components should be provided (para 17).

36. Consideration should be given to use of a seat cushion which would attenuate vibrations in the frequency range of the main rotor (para 19).

37. Consideration should be given to specifying the pilot station vibration limits in MIL-H-8501A as a function of frequency below 32 Hz (para 22).

38. Consideration should be given to installing an environmental control system for use in extreme environmental conditions (para 30).

APPENDIX A. REFERENCES

1. Letter, AVSCOM, AMSAV-EF, 31 August 1971, subject: AVSCOM Test Request No. 70-15, Instrument Panel, Avionics Compartment and Crew Station Environmental Study.

2. Final Report, USAASTA, Project No. 70-15-1, *Instrument Panel and Avionics Compartment Environmental Survey, Production OH-58A Helicopter*, September 1972.

3. Technical Manual, TM 55-1520-228-10, *Army Model OH-58A Helicopter*, 13 October 1970.

4. Test Plan, USAASTA, Project No. 70-15, *Helicopter Vibration and Environmental Survey*, July 1971.

5. Military Standard, MIL-STD-810B, *Environmental Test Methods*, 15 June 1967.

6. Military Specification, MIL-H-8501A, *Helicopter Flying and Ground Handling Qualities; General Requirements For*, 7 September 1961, Amended 3 April 1962.

7. Test Data Reduction Report, Northrop Corporation, Electronics Division, NORT 72-279, *Environmental Vibration Survey, UH-1H Helicopter-Iroquois*, August 1972.

8. Publication, Instut Royale Meteorologique de Belgique, *Donnes du Rayonnement Solaire a Leopoldville*, Periode 1953-1962, 1965.

9. Publication, D2-90577-2, R. A. Atlas and B. N. Charles, *Summary of Solar Radiation Characteristics, Tabular Summaries*, December 1964.

10. Department of the Army Technical Bulletin, TB MED 175, *The Etiology, Prevention, Diagnosis and Treatment of Adverse Effects of Heat*, 25 April 1969.

APPENDIX B. GENERAL AIRCRAFT INFORMATION

DIMENSIONS AND DESIGN DATA

Overall Dimensions

Aircraft length (rotor turning)	57 ft, 1.1 in.
Aircraft length (nose to tail skid)	41 ft, 11.1 in.
Width (rotor turning)	48 ft
Width (rotor static)	9 ft, 6.6 in.
Height (to top of rotor mast)	14 ft, 0.7 in.
Height (to top of turning tail rotor)	14 ft, 5.5 in.

Main Rotor

Number of blades	2
Diameter	48 ft
Blade chord (constant)	21 in.
Solidity	0.0464
Blade twist angle	-10.0 deg linear
Hub precone angle	2.75 deg
Airfoil type	NACA 0012

Tail Rotor

Number of blades	2
Diameter	8 ft, 6 in.
Blade chord	8.41 in.
Blade twist angle	Zero deg
Hub precone angle	Zero deg
Airfoil section designation and thickness (constant)	NACA 0015

Control Travel

Cyclic stick (measured at center of grip):	
Longitudinal	12.2 in.
Lateral	12.3 in.
Collective stick (measured at center of grip)	10.75 in.
Antitorque pedals (from neutral)	6.8 in.

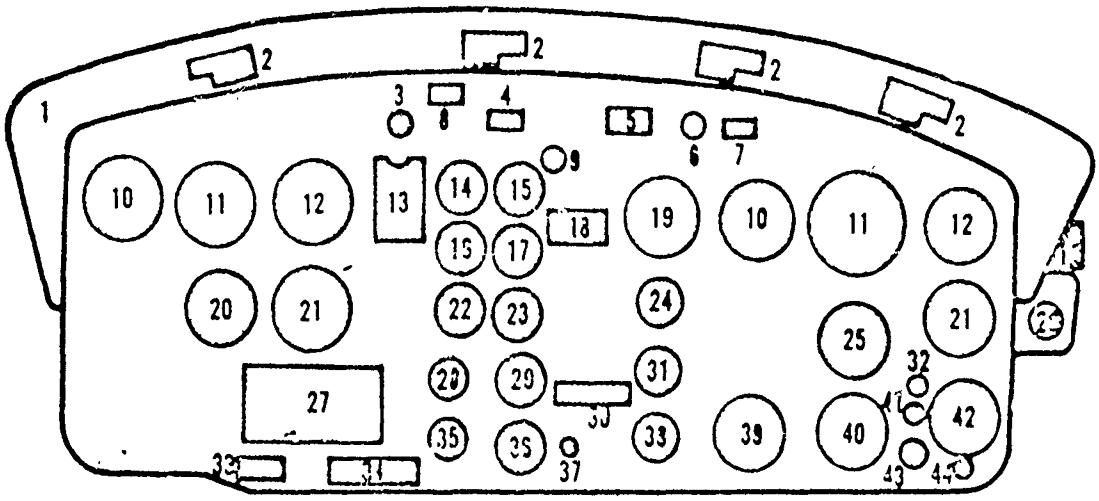
Gear Ratio

Engine to main rotor	20.370:1
Engine to tail rotor	3.990:1

Operating Limitations

Output shaft speed	6400 to 6600 rpm
Turbine outlet temperature	625°C (continuous) 645°C (30 minutes)
Rotor speed (power ON)	314 to 324 rpm
Rotor speed (power OFF)	294 to 339 rpm
Maximum airspeed (V_{max}), sea level	120 KIAS
Torque	50 psi (continuous)

Instrument Panel Configuration, UH-1H 67-17145



1. Glare Shield
2. Secondary Lights
3. Engine Air Filter Light
4. Master Caution
5. RPM Warning Light
6. Fire Detector Test Switch
7. Fire Warning Indicator Light
8. Radio Call Designator
9. Fuel Gage Test Switch
10. Airspeed Indicator
11. Attitude Indicator
12. Altimeter Indicator
13. Compass Correction Card Holder
14. Fuel Pressure Indicator
15. Fuel Quantity Indicator
16. Engine Oil Pressure Indicator
17. Engine Oil Temperature Indicator
18. Cargo Caution Decal
19. Dual Tachometer
20. Radio Compass Indicator
21. Vertical Velocity Indicator
22. Transmission Oil Pressure Indicator
23. Transmission Oil Temperature Indicator
24. Torquemeter Indicator
25. Radio Compass Indicator
26. Standby Compass
27. Operating Limits Decal
28. Main Generator Loadmeter
29. DC Voltmeter
30. Engine Caution Decal
31. Gas Producer Tachometer Indicator
32. Marker Beacon Light
33. Engine Installation Decal
34. Transmitter Selector Decal
35. Standby Generator Loadmeter
36. AC Voltmeter
37. Compass Slaving Switch
38. Exhaust Gas Temperature Indicator
39. Turn and Slip Indicator
40. Omni Indicator
41. Marker Beacon Sensing Switch
42. Clock
43. Marker Beacon Volume Control
44. Cargo Release Armed Light

AVIONICS EQUIPMENT CONFIGURATION, UH-1H S/N 67-17145

Item	Location
Control intercommunications set C-1611/AIC	Center console (2 each) Aft compartment (2 each)
Radio set AN/ARC-54:	
Receiver-transmitter RT-348/ARC-54	Nose compartment
Control radio set C-3835/ARC-54	Center console
Antenna AT-765/ARC-54	Tail boom above tail rotor
Coupler, antenna CU-943/ARC-54	Tail boom above tail rotor
Antenna assembly 637A-2	Front roof
Radio set AN/ARC-51BX:	
Receiver-transmitter RT-742/ARC-51BX	Nose compartment
Control radio set C-6287/ARC-51BX	Center console
Antenna AT-1108/ARC	Front roof
Radio set AN/ARC-134:	
Receiver-transmitter RT-857/ARC-134	Aft right compartment
Control panel C-7197/ARC-134	Center console
Gyromagnetic compass set AN/ASN-43:	
Induction compass transmitter T-611/AST	Aft tail boom
Electronic control amplifier AM3209/ASN	Nose compartment
Magnetic flux compensator CN-405/ASN	Aft tail boom
Directional gyro CN-988/ASN-43	Aft left compartment
Radio receiving set AN/ARN-82:	
Radio receiver R1388/ARN-82	Nose compartment
DMN 4-4 antenna	Aft tail boom
Control radio set C-6873/ARN-82	Center console

Direction finder set AN/ARN-83:

Radio receiver R-1391/ARN-83	Nose compartment
Control direction finder C6899/ARN-83	Center console
Antenna AS-1863/ARN-83	Front roof
Antenna 205-075-325	Center bottom of aircraft

Transponder set AN/APX-44:

Transponder set control C-2714/APX-44	Center console
Antenna AT-884/APX-44	Bottom of nose section

APPENDIX C. TEST CONFIGURATIONS

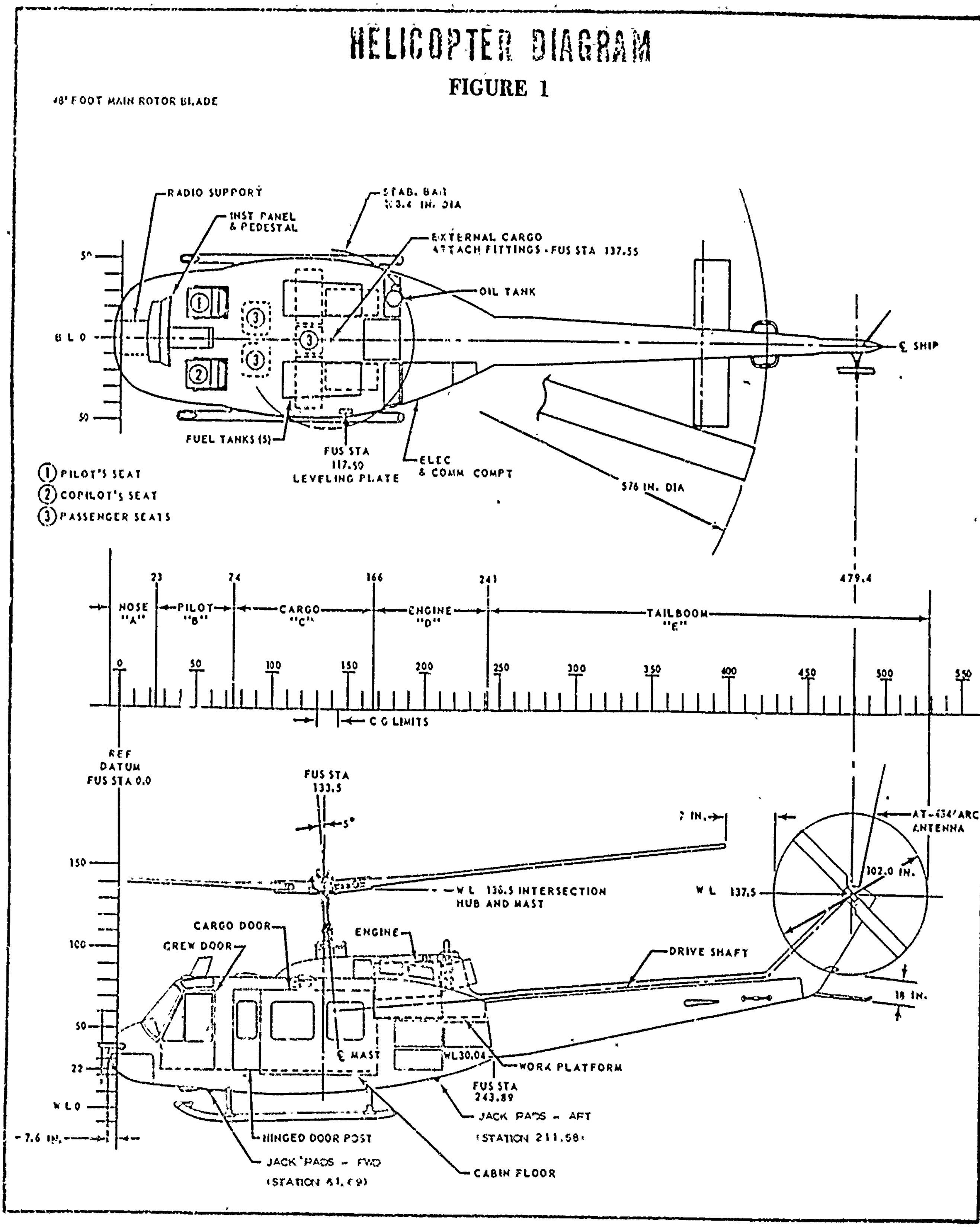


FIGURE 1

Table 1. Light Weight Test Configuration.[1]

Item	Weight (lb)	Longitudinal Fuselage Station (in.)	Lateral Fuselage Station (in.)	Longitudinal Moment (in.-lb)	Lateral Moment (in.-lb)
Basic aircraft	5698	--	--	810,266	-4096
Average fuel	752	--	--	102,500	0.0
Instrumentation	150	100.0	-30	15,000	-3000
Pilot	200	46.7	+22	9,340	+4400
Engineer	200	46.7	-22	9,340	-4400
Test conditions	7000	135.2 (mid)	-1.0, left	946,446	-7096

[1]Clean (doors closed).

Table 2. Heavy Weight Test Configuration.[1]

Item	Weight (lb)	Longitudinal Fuselage Station (in.)	Lateral Fuselage Station (in.)	Longitudinal Moment (in.-lb)	Lateral Moment (in.-lb)
Basic aircraft	5698	--	--	810,266	-4096
Average fuel	897	--	--	126,000	0.0
Instrumentation	150	100.0	-30	15,000	-3000
Pilot	225	46.7	+22	10,508	+4950
Engineer	225	46.7	-22	10,508	-4950
Ballast	225	90.0	+12	20,250	+2700
Ballast	225	125.0	+35	28,125	+7875
Ballast	225	125.0	+20	28,125	+4500
Ballast	225	125.0	0.0	28,125	0.0
Ballast	225	145.0	+25	32,625	+5625
Ballast	225	145.0	-25	32,625	-5625
Ballast	225	160.0	+25	36,000	+5625
Ballast	230	160.0	-25	36,800	-5750
Test conditions	9000	135.0 (mid)	0.9, right	1,214,957	7854

[1]Clean (doors closed).

Table 3. Armed Test Configuration.[1]

Item	Weight (lb)	Longitudinal Fuselage Station (in.)	Lateral Fuselage Station (in.)	Longitudinal Moment (in.-lb)	Lateral Moment (in.-lb)
Basic aircraft	5698	--	--	810,266	-4096
Average fuel	926	--	--	130,500	0.0
Instrumentation	150	100.0	-30	15,000	-3000
Pilot	200	46.7	+22	9,340	+4400
Engineer	200	46.7	-22	9,340	-4400
Gunner	200	150.0	+25	30,000	+5000
Gunner	200	150.0	-25	30,000	-5000
M23 armament subsystem	126	150.0	0.0	18,900	0.0
Average ammunition	200	122.0	+15	24,400	+3000
Ballast	200	85.0	+12	17,000	+2400
Test conditions	8100	135.2 (mid)	-0.2, left	1,094,746	-1696

[1]M23 armament subsystem (cargo doors open).

APPENDIX D. TEST INSTRUMENTATION

GENERAL

1. Flight test instrumentation was installed, calibrated, and maintained by the Instrumentation and Calibration Divisions of USAASTA and USAAMRDL. This instrumentation was used to record vibration data, temperature data, and flight condition parameters. A list of the instrumentation components is presented in table 1.

VIBRATION INSTRUMENTATION

2. An FM-FM magnetic tape system, was used to record the vibration data. A block diagram of the instrumentation system is presented in figure 1. Data were recorded over a frequency range of 2 to 2000 Hz for all flight conditions. The transducers were miniature triaxial, biaxial, and uniaxial piezoelectric accelerometers which were mounted at 49 locations throughout the aircraft for a total of 140 channels of vibration data. The instrumentation was limited to recording data from 12 accelerometers simultaneously. To record more than 12 channels of data, an eight-position manual switching network was employed and each flight condition was repeated seven times, for a maximum data capacity of 96 channels. To obtain the total of 140 channels of vibration data, the accelerometers were relocated after completion of all test conditions and the test conditions were repeated. The lift link triaxial accelerometer was common to all switch positions to verify repetition of each test condition. The maximum capacity of the instrumentation system is 96 channels without accelerometer relocation and 192 channels with one relocation. Accelerometers were bonded to the component of interest with the accelerometer axis aligned to the component axis. The mounting locations of each accelerometer are shown in the photographs in appendix E. Table 2 lists the accelerometer locations, accelerometer type, and amplitude range.

3. The vibration instrumentation was calibrated to determine the amplitude sensitivity and frequency response of the total data system. A frequency sweep was performed on each accelerometer with an electrodynamic shaker. Each accelerometer was mounted back to back with a calibrated reference accelerometer and the charge sensitivity (picocoulomb/g) and frequency response of the test accelerometer determined by comparison with the reference accelerometer. The airborne data recording system was calibrated by means of a charge source. For each channel, the charge source was set to simulate a given acceleration value by reference to the accelerometer charge sensitivity determined by the shaker calibration, and the airborne data system output was recorded. The ground station was calibrated separately from the airborne system, and the two system scale factors were combined to obtain an overall data system scale factor. It is estimated that the accuracy of the total vibration measurement system, both airborne and ground units, is within ±10 percent of the true acceleration amplitude.

Table 1. Instrumentation Component Description.

Nomenclature	Manufacturer	Quantity	Model Number
Piezoelectric accelerometer (triaxial)	Endevco	23	2228C
Piezoelectric accelerometer (uniaxial)	Endevco	17	2226C
Piezoelectric accelerometer (uniaxial)	Endevco	6	2242C
Piezoelectric accelerometer (triaxial)	Endevco	2	2223C
Piezoelectric accelerometer (uniaxial)	Endevco	2	2224C
Line driver	MB Electronics	81	9402216
Amplifier	MB Electronics	12	N400
Switching relays	Potter and Brumfield	24	JDT27DD1
FM rack	Electro Mechanical Research	2	--
FM rack voltage code oscillator (VCO)	Electro Mechanical Research	12	307A-02
FM rack mixing amplifier	Electro Mechanical Research	2	311A-02-1
FM rack reference oscillator	Electro Mechanical Research	2	313A-01
Tape recorder	Genisco Technology Corp.	1	10-286
Time code generator	Electro Mechanical Research	1	CL24D-27.6A
Thermocouple switch (24 channels)	Thermo Electric	1	33113
Thermocouple indicator	Newport Laboratories	1	2600
Thermocouple wire (iron-constantan)	Series J	--	--
Thermal radiometer	Teledyne Geotech	1	TCH-188-01

FIGURE 1
AIRBORNE DATA SYSTEM

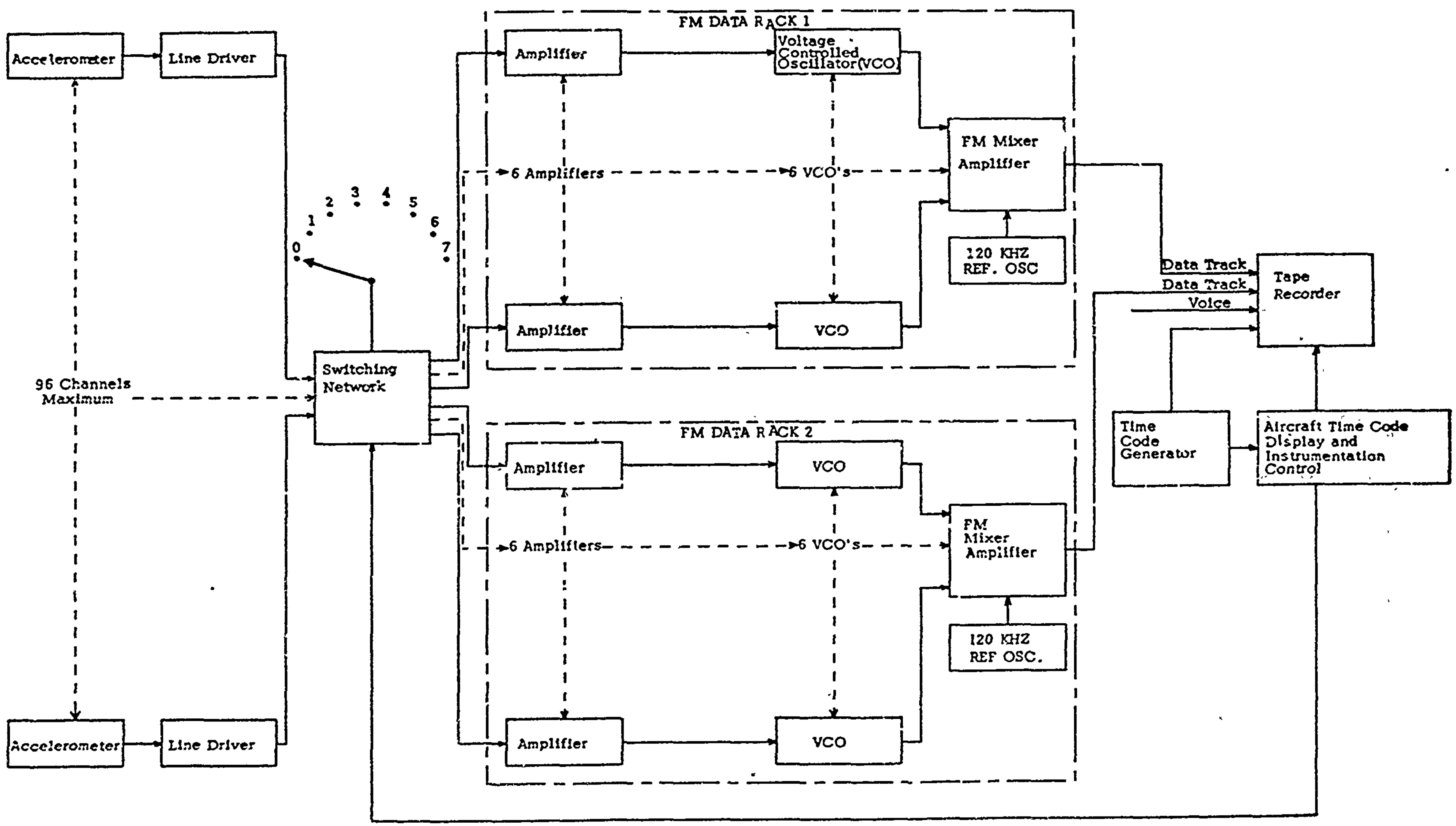


Table 2. Accelerometer Locations.

Location	Location Number	Fuselage Station (in.)	Water Line (in.)	Buttline (in.)	Axis	Full Scale Acceleration Range (± g)	Accelerometer Type
Instrument panel	1	31.8	56.3	10.2L	3	5	2228C
	2	34.2	46.9	8.2L	3	5	2228C
	3	33.7	49.0	3.8R	3	5	2228C
	4	31.8	56.3	15.3R	3	5	2228C
	5	34.6	45.4	22.0R	3	5	2228C
Avionics							
MD-1 vertical gyro	6	17.8	42.9	11.5R	3	5	2228C
MD-1 vertical gyro mount	7	17.5	4.9	11.5R	3	5	2226C
Left rear compartment	8	200.0	40.8	26.7L	3	5	2228C
RT-348/ARC-54 radio	9	8.0	25.2	3.7L	3	5	2228C
RT-348/ARC-54 radio mount	10	6.5	23.5	3.7L	3	5	2226C
Pilot							
Seat pad plate	11	58.8	35.0	22.8R	3	5	2228C
Seat structure	12	56.7	30.8	22.8R	3	5	2242C
Right pedal foot rest	13	26.9	24.7	29.2R	Vertical, lateral	5	2226C
Collective grip[1]	14	42.5	40.2	11.3R	Vertical	5	2226C
Cyclic grip[2]	15	43.6	44.0	22.9R	3	5	2228C
Pilot's helmet (SPH-4)	16	--	--	--	3	5	2228C
Bite block	17	--	--	--	3	5	2228C
Transmission mounts							
Forward left	18	138.8	69.6	12.7L	3	50	2228C
Forward right	19	138.8	69.6	12.7R	3	50	2228C
Aft right	20	156.7	71.7	12.7L	3	50	2228C
Aft left	21	156.7	71.7	12.7R	3	50	2228C
Tail boom attach points							
Upper left	22	246.5	67.0	12.5L	3	5	2228C
Lower right	23	251.5	34.4	12.5R	3	5	2228C
Engine compartment, deck							
Joint	24	185.6	58.2	26.2L	3	5	2228C
Panel	25	203.5	58.2	26.2L	3	5	2228C
Engine compartment, forward							
Firewall, side	26	174.0	70.7	28.3L	3	5	2228C
Firewall, center	27	174.0	70.7	Zero	3	5	2228C
Engine mounts							
Left forward	28	179.4	77.2	8.8L	3	5	2228C
Left aft	29	200.0	75.8	11.8L	3	5	2228C
Tail rotor servo bulkhead	30	219.6	37.7	7.9R	3	5	2228C
Oil cooler	31	227.2	40.8	3.7R	3	5	2228C
Tail rotor shaft 42-degree gearbox	32	441.2	87.7	Zero	3	100	2223C
Tail rotor shaft 90-degree gearbox	33	486.6	138.7	4.6L	3	100	2228C
Hydraulic servo, transmission bay	34	137.1	50.3	6.1L	3	5	2228C
Fuel boost pump, right	35	118.3	11.7	33.7R	3	5	2228C
Gas producer tach generator	36	118.6	80.0	6.2R	3	100	2223C
Main rotor tach generator	37	145.8	63.3	9.2R	3	50	2226C
Power turbine tach generator	38	187.9	86.8	9.6L	3	50	2226C
Tail rotor shaft hanger bearing							
No. 1	39	222.5	68.8	0.8L	Vertical, lateral	100	2224C
No. 2	40	245.8	70.0	0.8L	Vertical, lateral	50	2226C
No. 3	41	308.9	75.2	0.8L	Vertical, lateral	50	2226C
No. 4	42	371.8	80.8	0.8L	Vertical, lateral	50	2226C
Lift link	43	144.0	59.4	1.7L	3	5	2242C
Engine mount, right	44	200.0	75.8	12.5R	3	5	2228C
Left fuel boost pump	45	118.3	11.7	33.7R	3	5	2228C
Engine							
Aft bottom	46	213.6	73.1	Zero	3	100	2228C
Front top	47	185.6	91.2	Zero	3	100	2228C
Mid top	48	202.5	96.2	Zero	3	100	2228C
Gun mount, left side	49	138.3	20.8	52.3R	3	100	2228C

[1]Collective full down.
[2]Cyclic centered.

TEMPERATURE INSTRUMENTATION

4. Temperature data were recorded by mounting thermocouples at 20 locations throughout the helicopter. The temperatures were displayed on one temperature indicator which was switched to the desired thermocouple. Table 3 lists the locations of the thermocouples and the temperature measurement equipment is described in table 1. Photographs of the thermocouple locations are presented in appendix E. Solar radiation was recorded on the ground with a calibrated radiometer. Outside air temperature (OAT) was recorded with a laboratory thermometer for static temperature measurements and with the ship's OAT indicator for in-flight temperature measurement.

Table 3. Thermocouple Locations.

Location	Location Number	Fuselage Station (in.)	Water Line (in.)	Buttline (in.)
Forward avionics	1	18.3	45.8	10.0R
Aft avionics	2	200.0	45.8	18.3L
Forward cabin	3	56.7	77.5	Zero
Aft cabin	4	130.0	81.7	Zero
Forward transmission compartment	5	145.0	65.0	Zero
Aft transmission compartment	6	158.3	75.0	Zero
Upper engine compartment	7	190.8	96.7	Zero
Lower engine compartment	8	200.0	59.2	Zero
42-degree gearbox	9	440.8	86.7	Zero
90-degree gearbox	10	487.4	139.1	4.2L
Oil cooler	11	231.6	36.7	4.2R
Right fuel boost pump	12	118.3	10.8	33.3R
Left fuel boost pump	13	118.3	10.8	33.3L
No. 1 hanger bearing	14	222.5	69.2	0.8L
No. 2 hanger bearing	15	245.8	70.0	0.8L
No. 3 hanger bearing	16	310.0	75.0	0.8L
No. 4 hanger bearing	17	372.4	80.8	0.8L
Gas producer tach generator	18	188.3	85.8	10.0L
Power turbine tach generator	19	189.1	80.8	5.8R
Main rotor tach generator	20	163.3	64.2	9.2R

FLIGHT CONDITION PARAMETERS

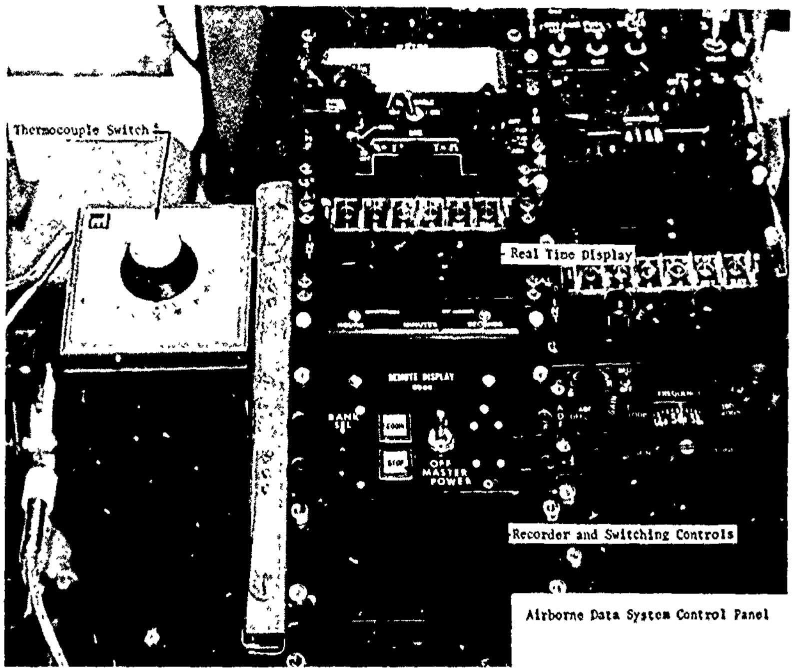
5. The parameters listed in table 4 were hand-recorded from the ship's standard instruments to determine the flight condition. The readability for each instrument listed in table 4 was determined by dividing the smallest increment marked on the dial by 5.

Table 4. Flight Condition Parameters.

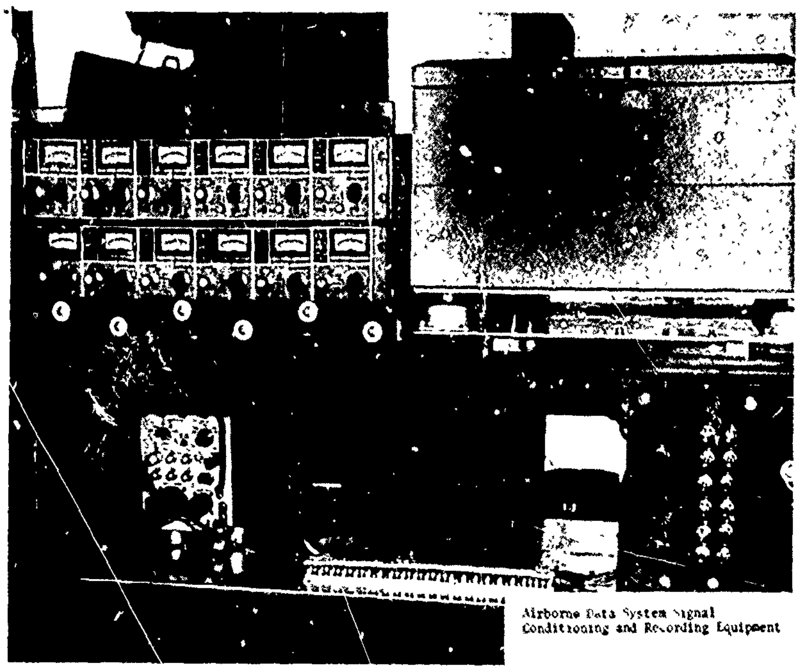
Parameter	Range of Interest	Readability
Airspeed	20 to 120 knots	±1.0 knot
Altitude	Zero to 10,000 feet	±4.0 feet
Outside air temperature	Zero to 30°C	±0.4°C
Main rotor speed	294 to 324 rpm	±2.0 rpm
Gas producer speed	60 to 101.5 percent	±0.2 percent
Fuel quantity	Zero to 1400 pounds	±4.0 pounds

APPENDIX E. INSTRUMENTATION PHOTOGRAPHS

Index



Airborne Data System Control Panel


Airborne Data System Signal Conditioning and Recording Equipment

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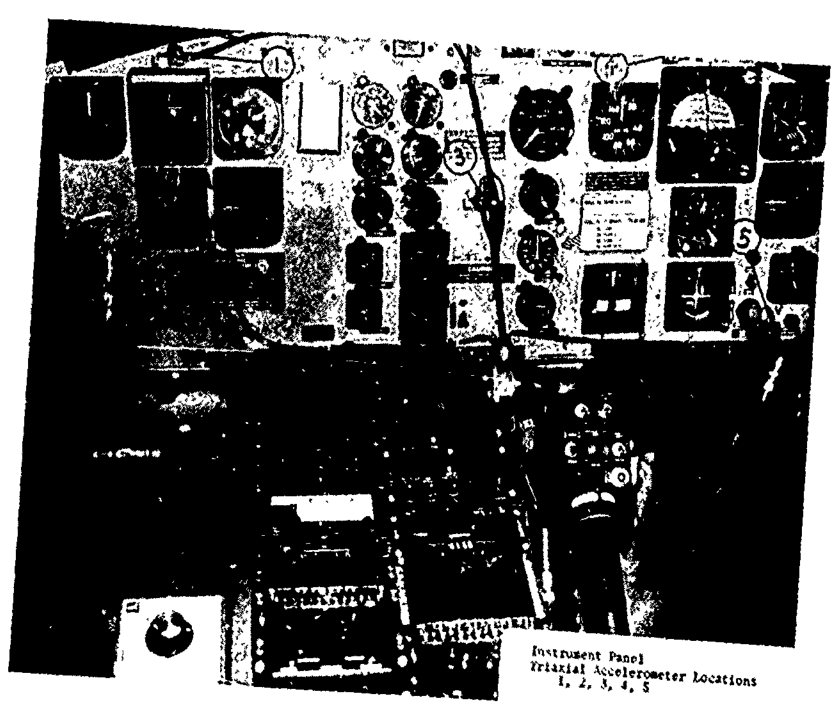
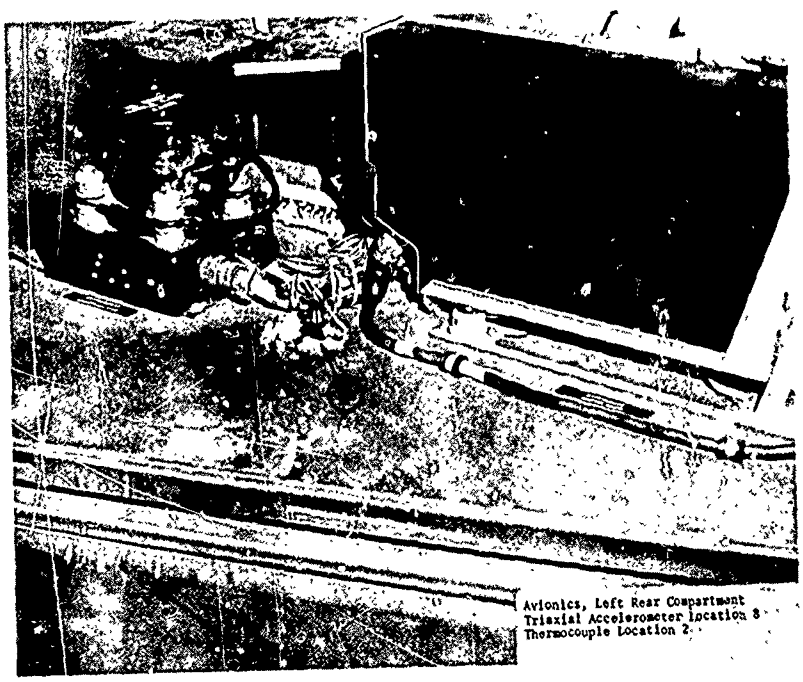
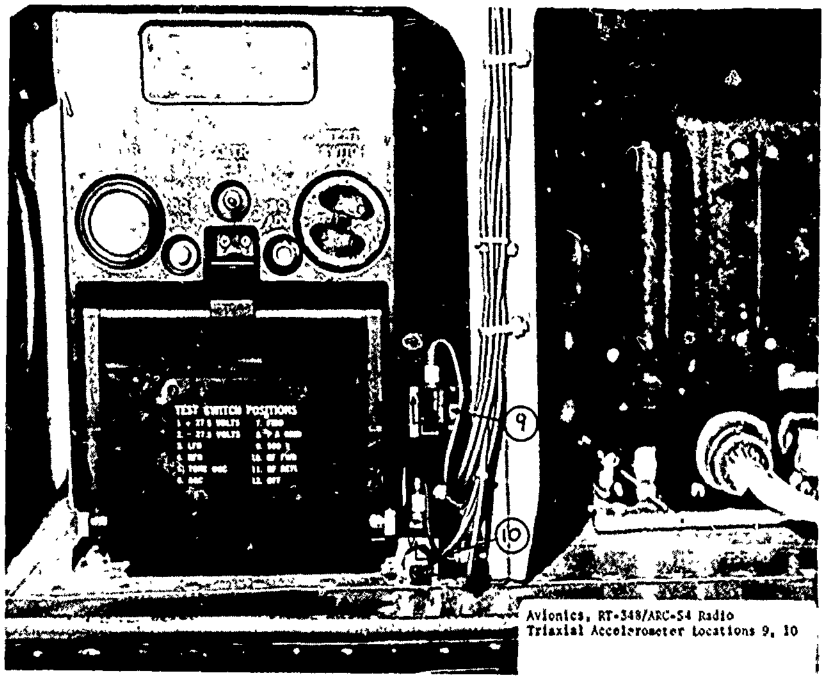


Instrument Panel
Triaxial Accelerometer Locations
1, 2, 3, 4, 5

Avionics, MD-1 Vertical Gyro
Triaxial Accelerometer Locations 6, 7
Thermocouple Location 1

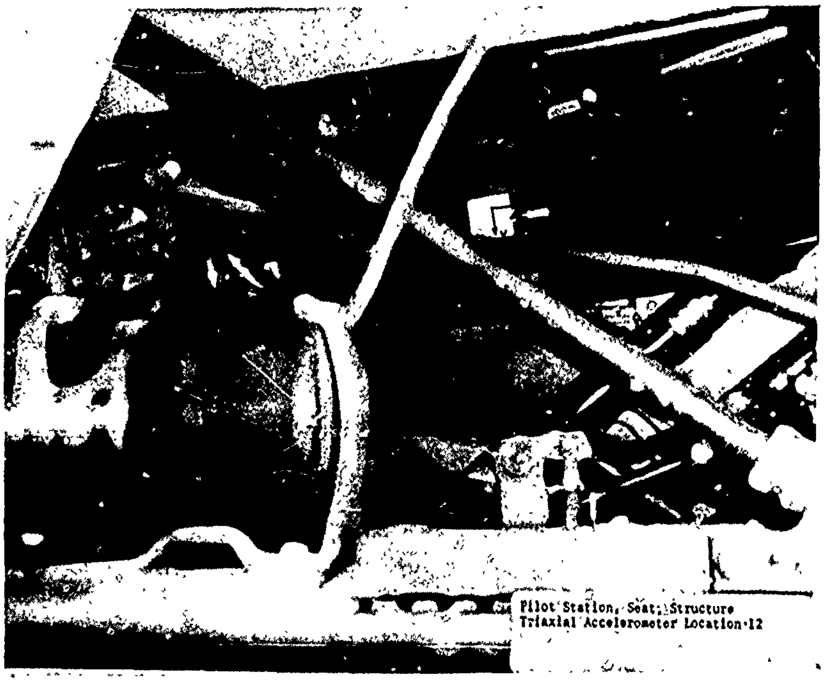


Avionics, Left Rear Compartment
Triaxial Accelerometer Location 8
Thermocouple Location 2

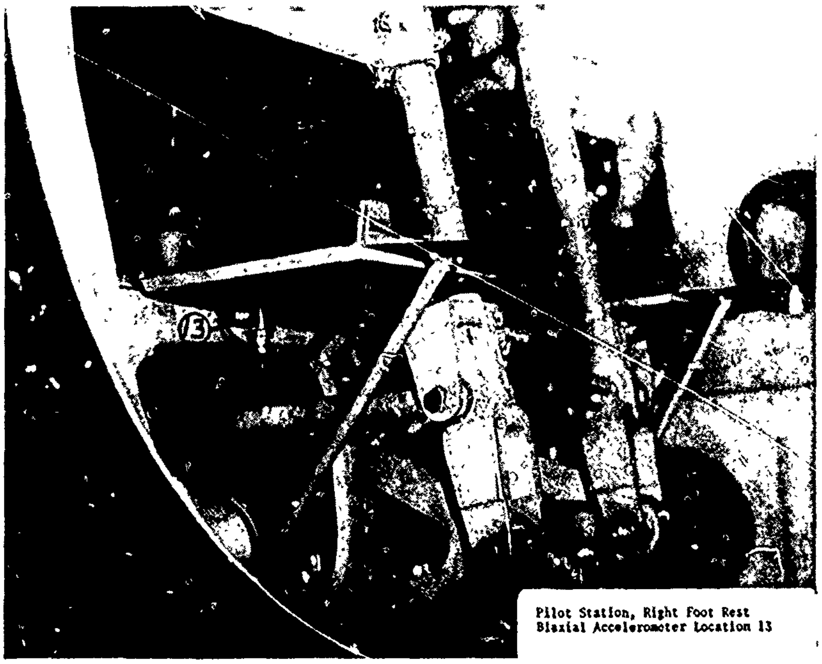


Avionics, RT-348/ARC-54 Radio
Triaxial Accelerometer Locations 9, 10

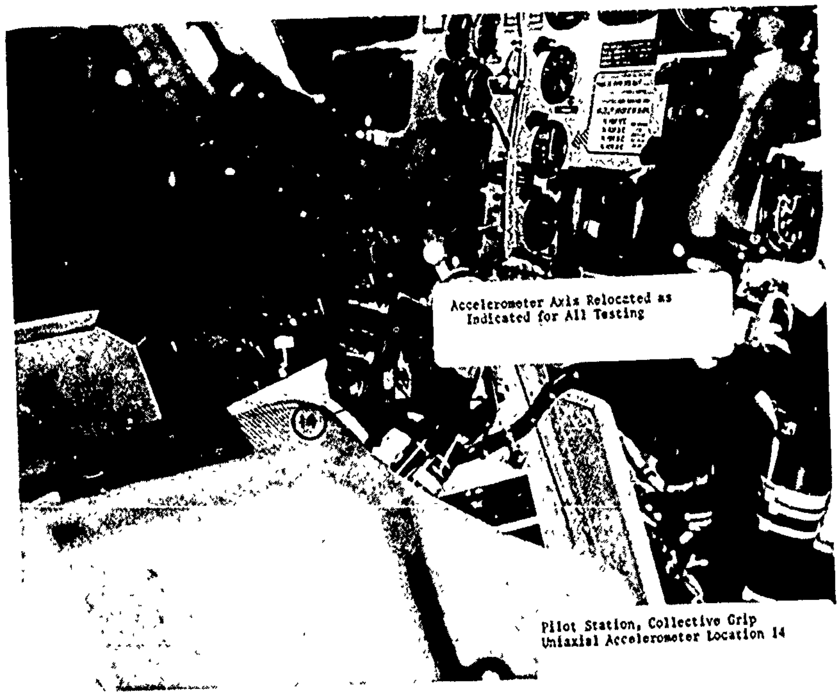
Pilot Station, Seat Pad
Triaxial Accelerometer Location 11



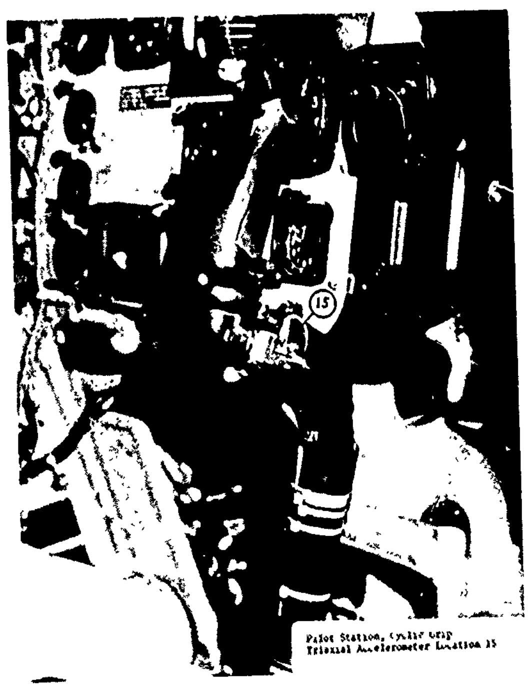
Pilot Station, Seat, Structure
Triaxial Accelerometer Location 12



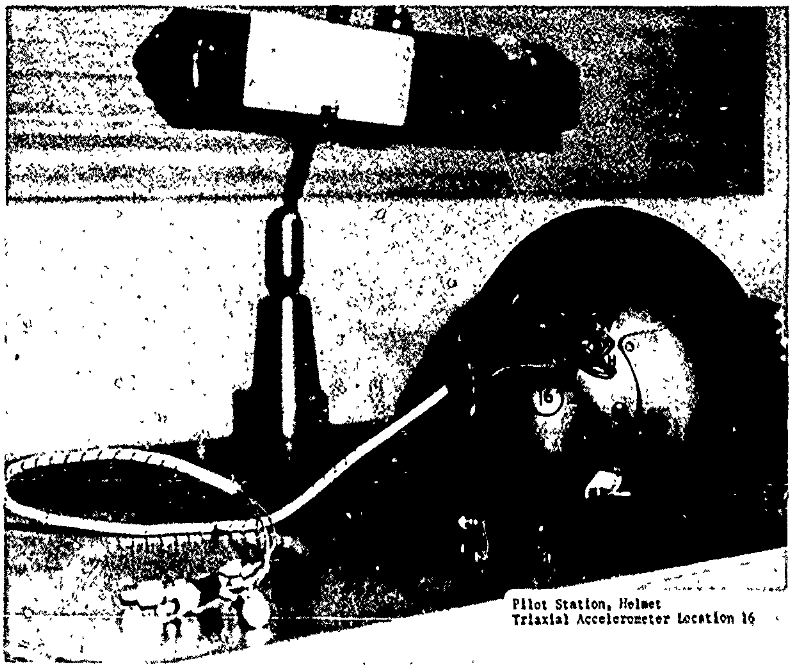
Pilot Station, Right Foot Rest
Biaxial Accelerometer Location 13



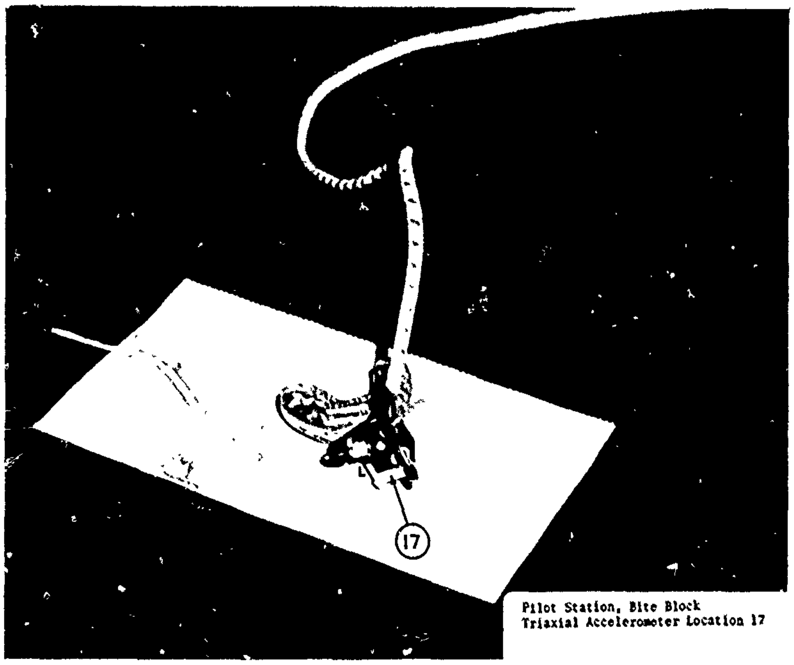
Pilot Station, Collective Grip
Uniaxial Accelerometer Location 14



Pilot Station, Cyclic Grip
Triaxial Accelerometer Location 15

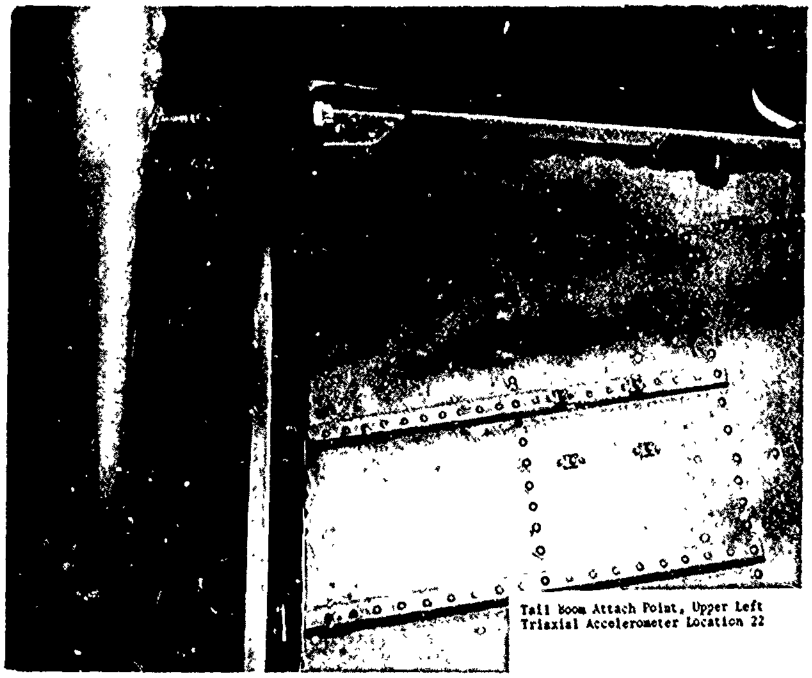


Pilot Station, Helmet
Triaxial Accelerometer Location 16

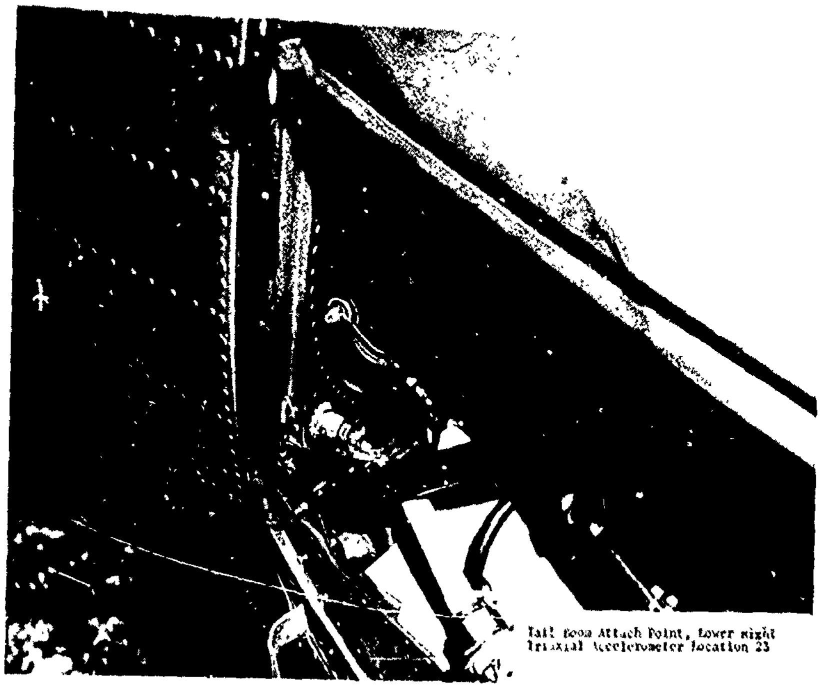


Pilot Station, Bite Block
Triaxial Accelerometer Location 17

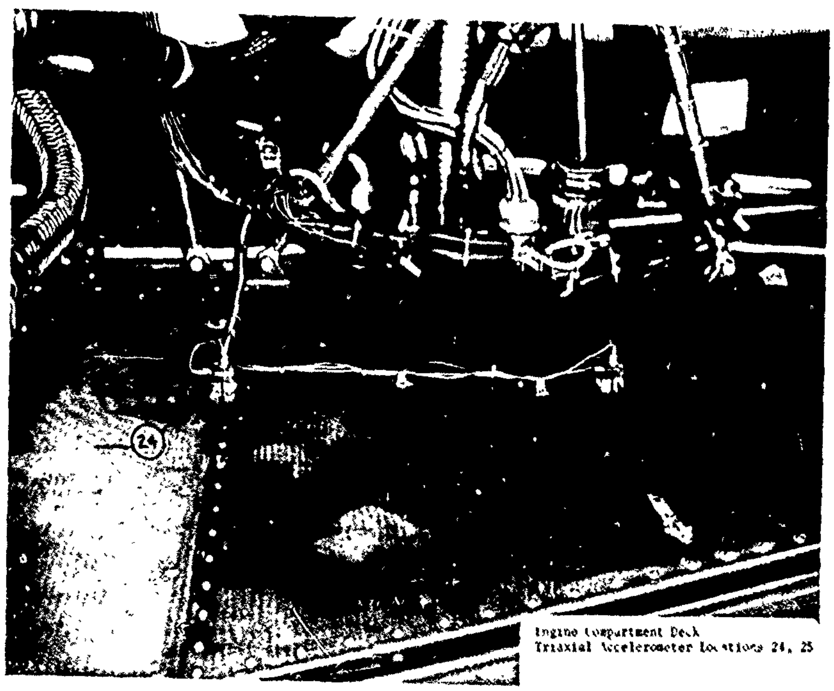
Left Forward Transmission Mount
Triaxial Accelerometer Location 18
(Not shown: Accelerometers mounted at right forward, right aft, and left aft transmission corners in identical manner). Locations 19, 20, 21



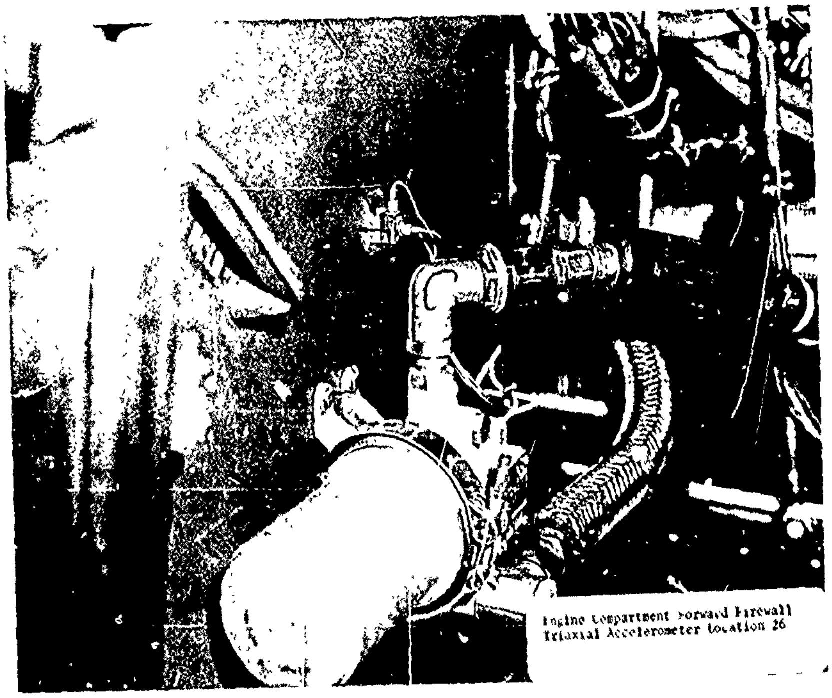
Tail Boom Attach Point, Upper Left
Triaxial Accelerometer Location 22



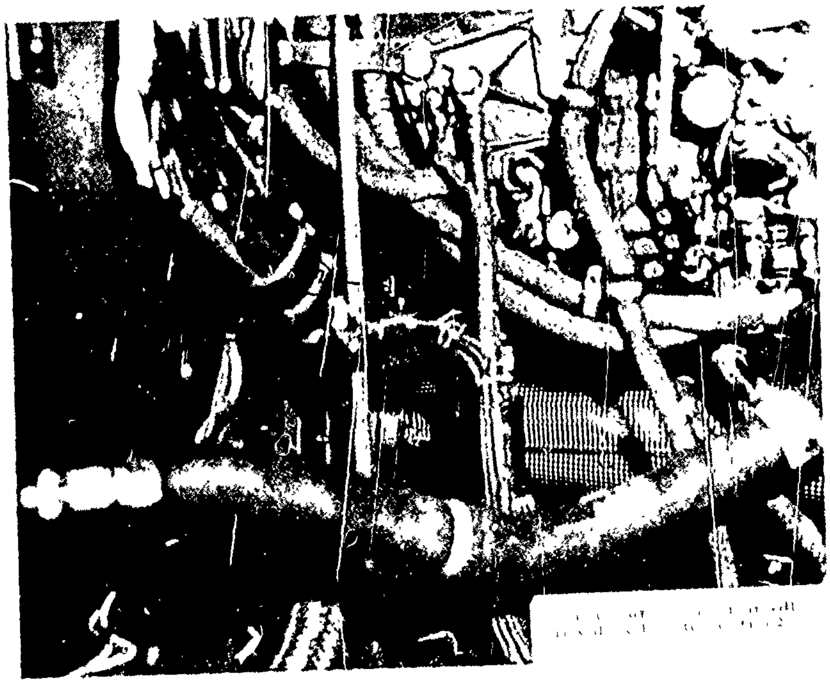
Tail Boom Attach Point, Lower Right
Triaxial Accelerometer Location 23



Engine Compartment Deck
Triaxial Accelerometer Locations 24, 25



Engine Compartment Forward Firewall
Triaxial Accelerometer Location 26



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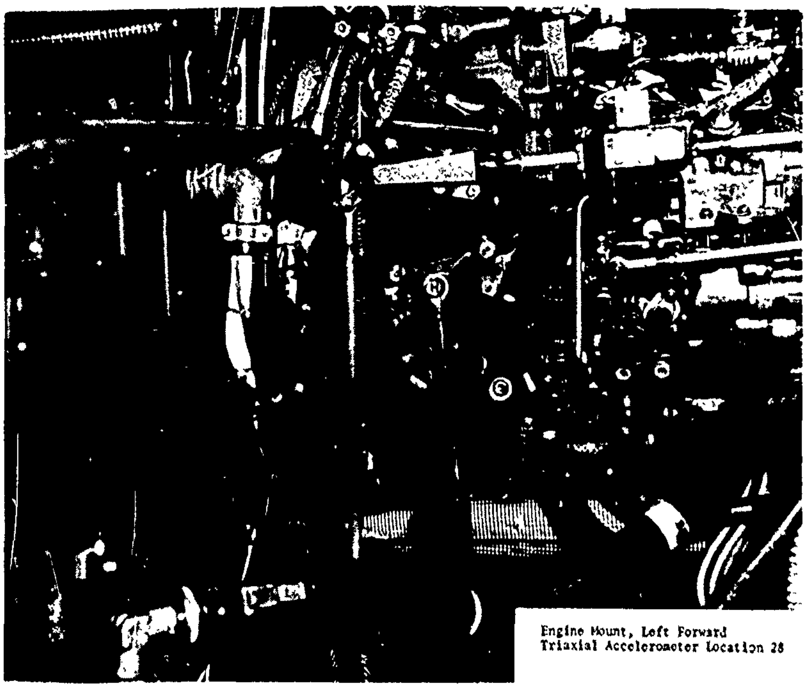
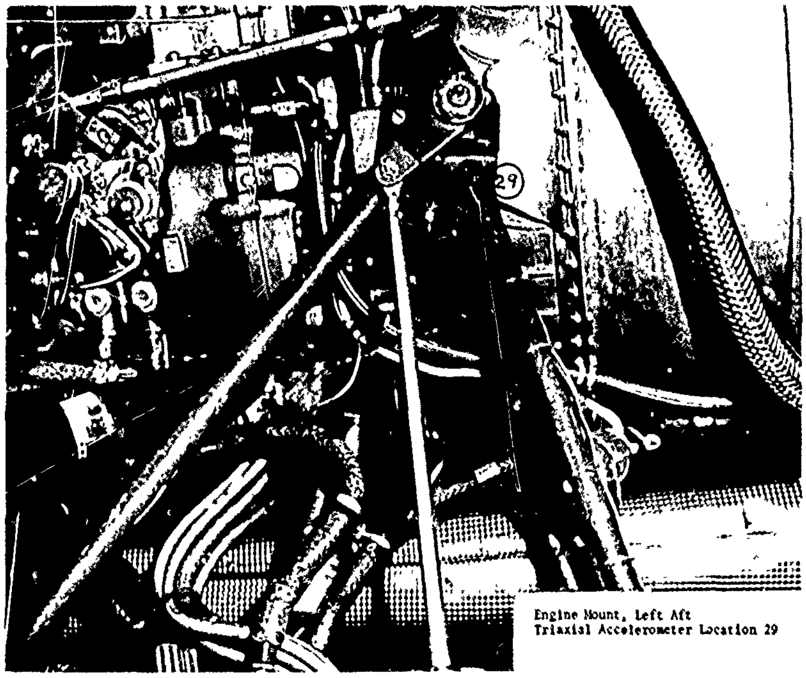
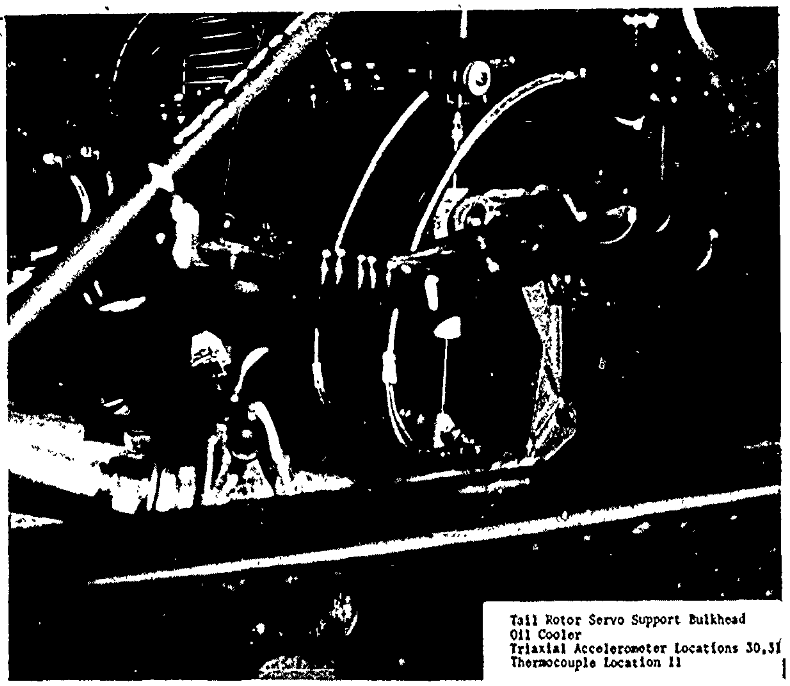


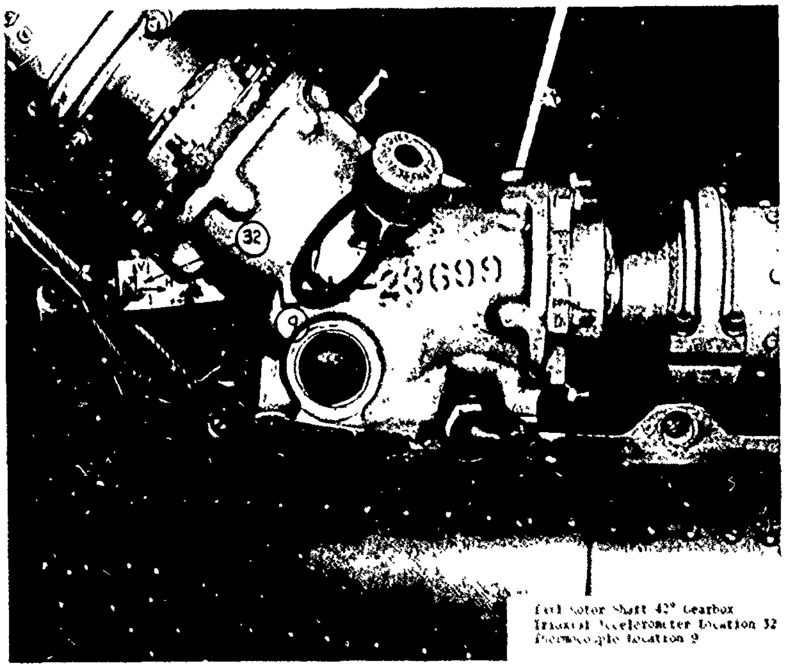
Engine Mount, Left Forward
Triaxial Accelerometer Location 28



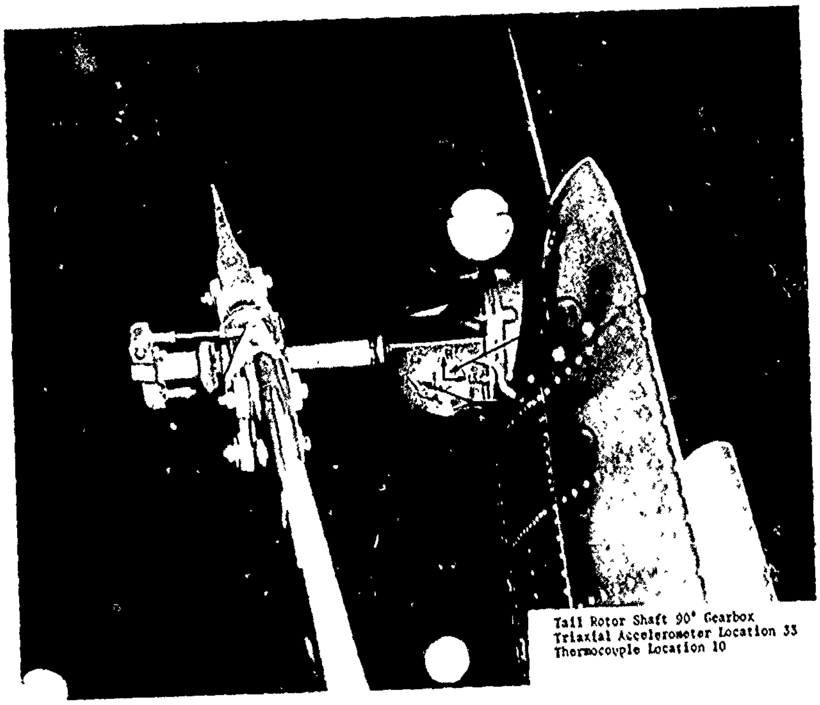
Engine Mount, Left Aft
Triaxial Accelerometer Location 29



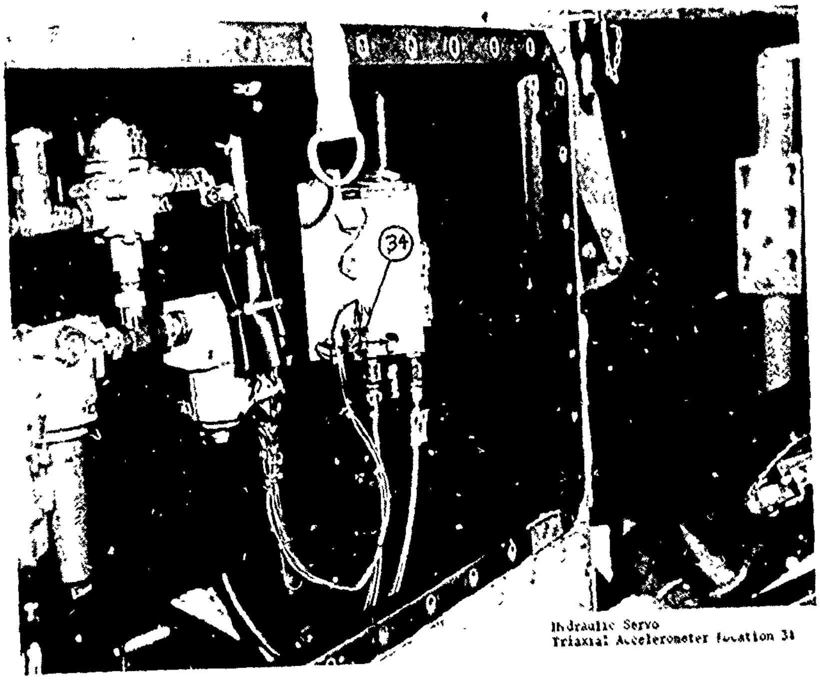
Tail Rotor Servo Support Bulkhead
Oil Cooler
Triaxial Accelerometer Locations 30,31
Thermocouple Location 11



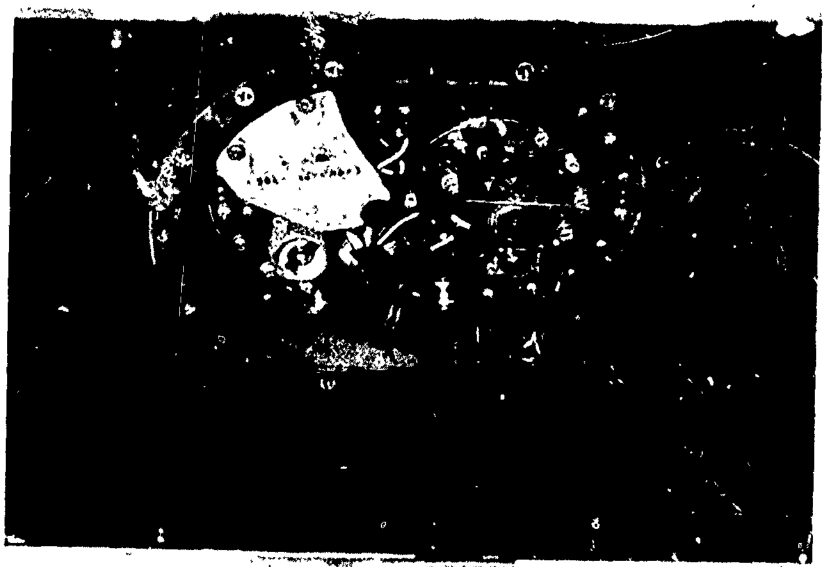
Tail Rotor Shaft 42° Gearbox
Triaxial Accelerometer Location 32
Thermocouple Location 9



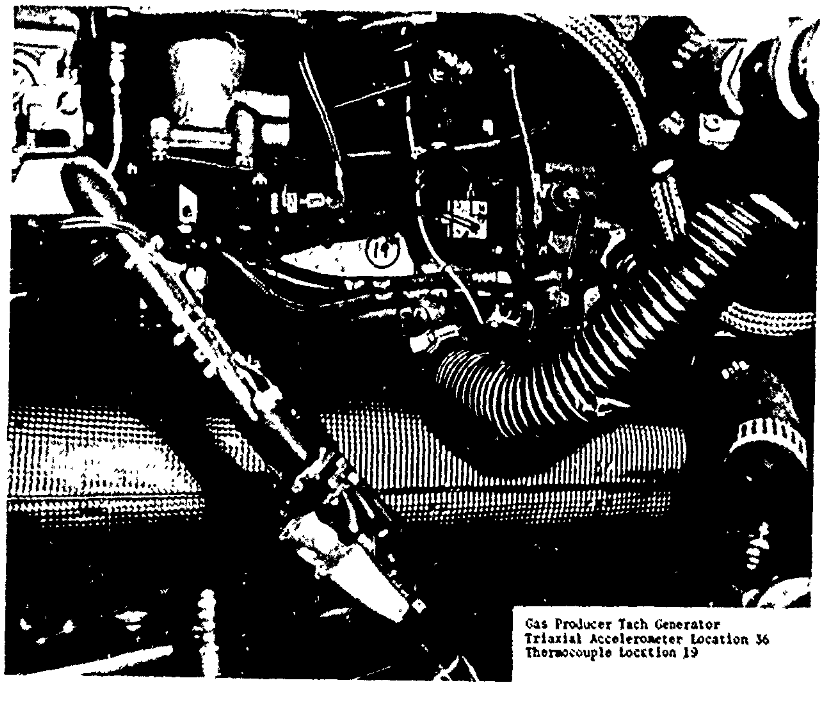
Tail Rotor Shaft 90° Gearbox
Triaxial Accelerometer Location 33
Thermocouple Location 10



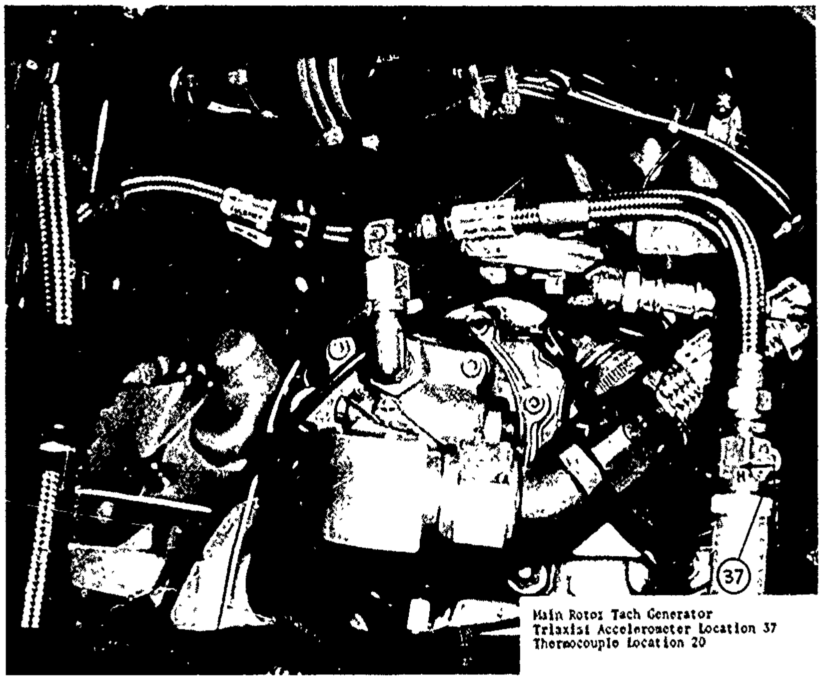
Hydraulic Servo
Triaxial Accelerometer Location 34



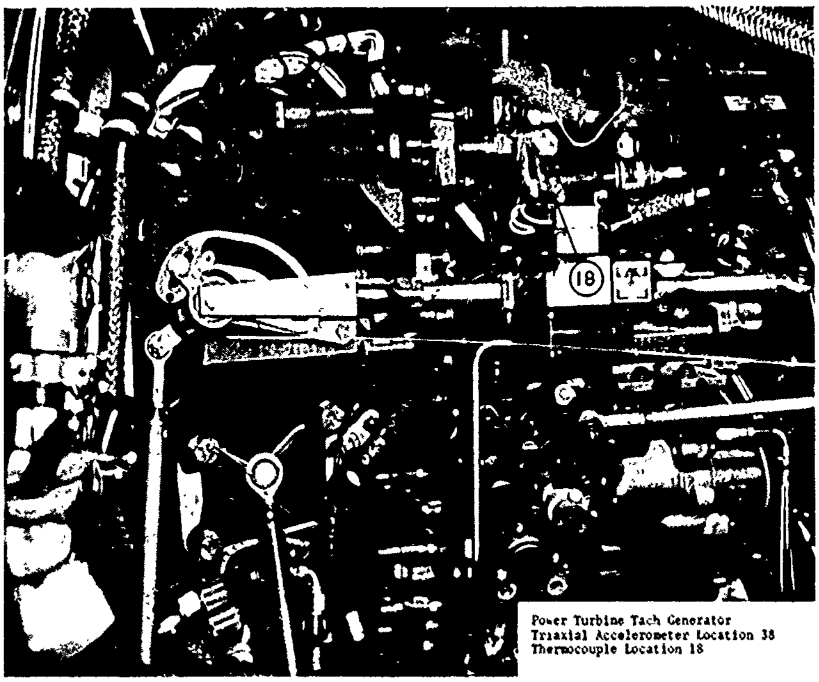
Right Fuel Boost Pump
Triaxial Accelerometer Location 35
Thermocouple Location 12



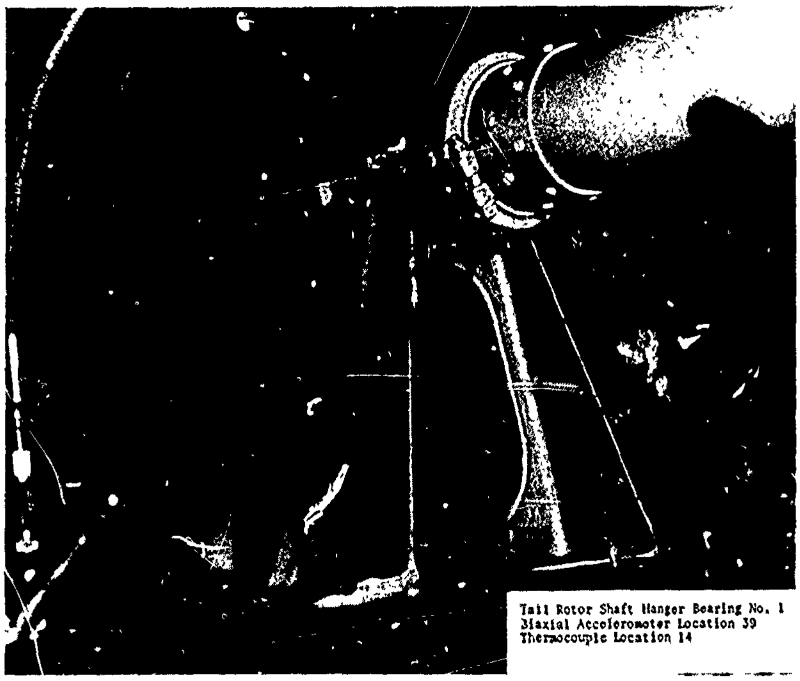
Gas Producer Tach Generator
Triaxial Accelerometer Location 36
Thermocouple Location 19



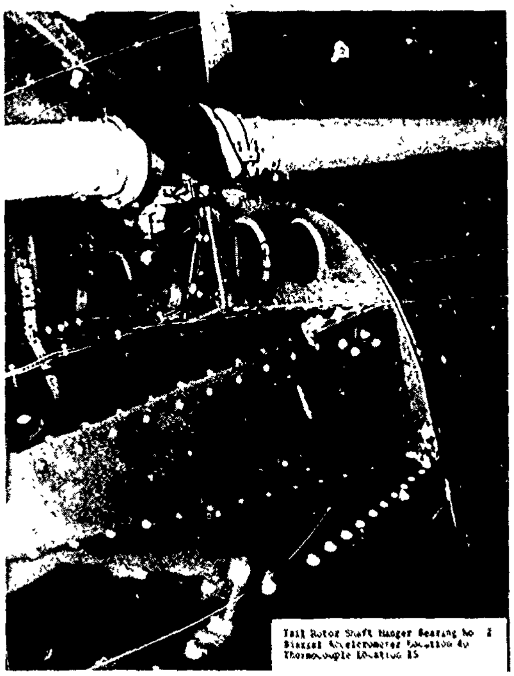
Main Rotor Tach Generator
Triaxial Accelerometer Location 37
Thermocouple Location 20



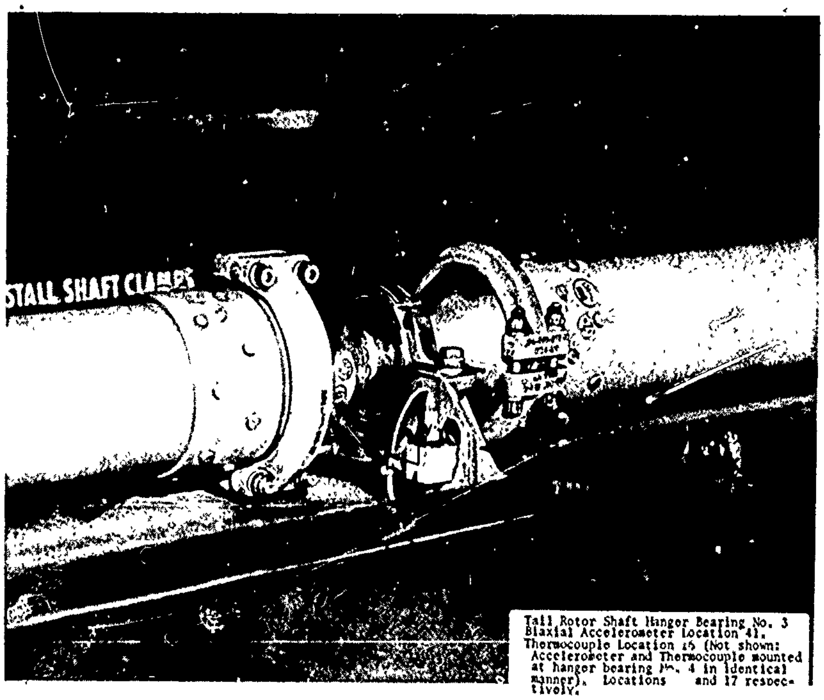
Power Turbine Tach Generator
Triaxial Accelerometer Location 38
Thermocouple Location 18



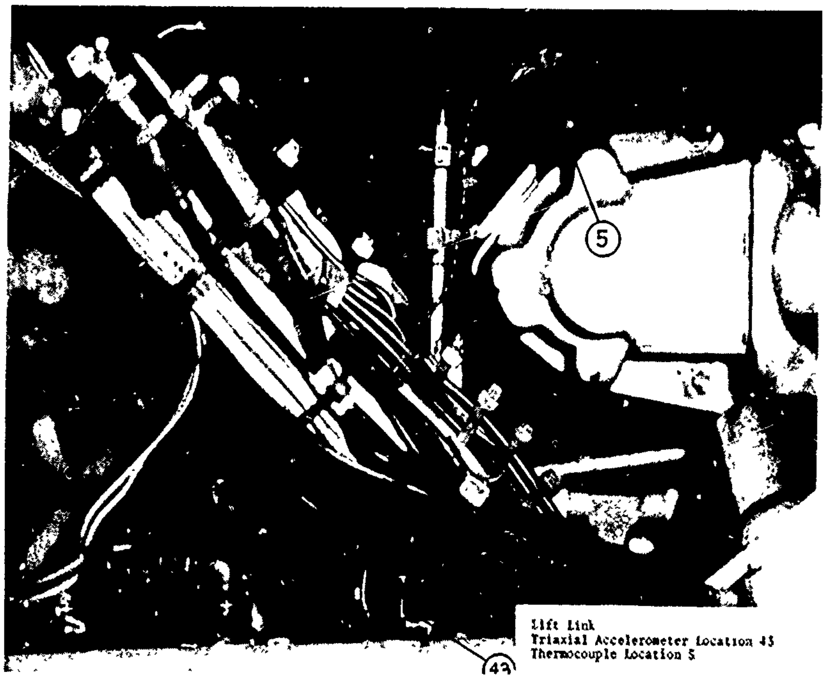
Tail Rotor Shaft Hanger Bearing No. 1
Biaxial Accelerometer Location 39
Thermocouple Location 14



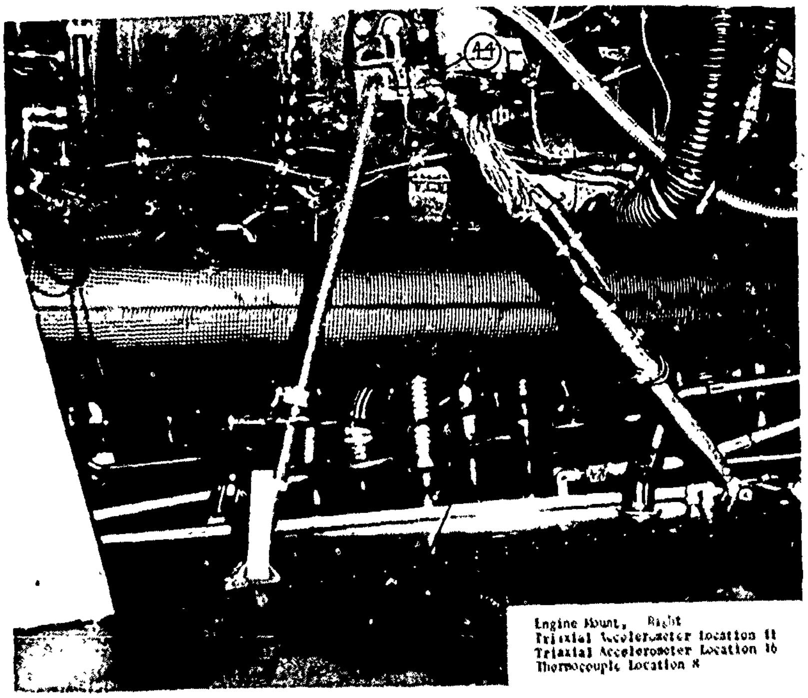
Tail Rotor Shaft Hanger Bearing No. 2
Biaxial Accelerometer Location [illegible]
Thermocouple Location 15



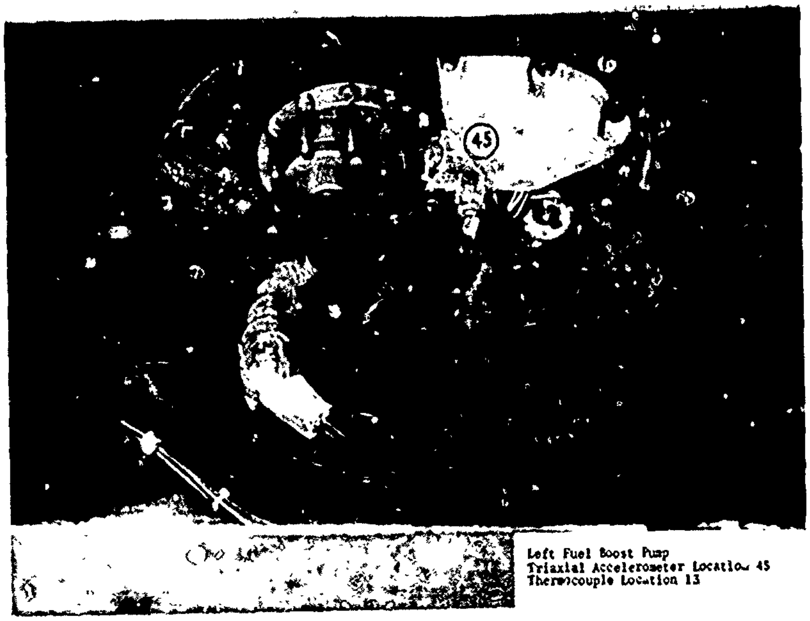
Tail Rotor Shaft Hangor Bearing No. 3
Biaxial Accelerometer Location 41.
Thermocouple Location 16 (Not shown:
Accelerometer and Thermocouple mounted
at hangor bearing No. 4 in identical
manner). Locations and 17 respectively.



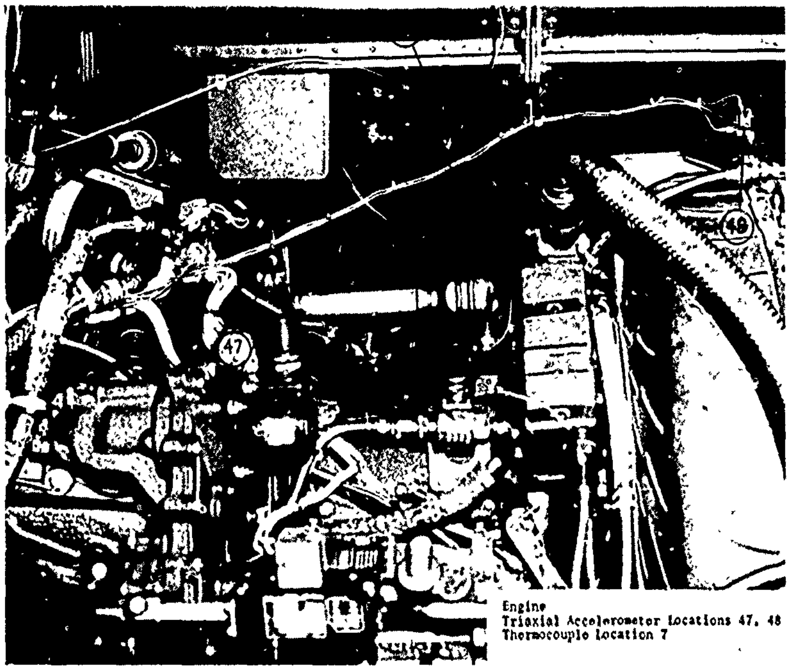
Lift Link
Triaxial Accelerometer Location 43
Thermocouple Location 5



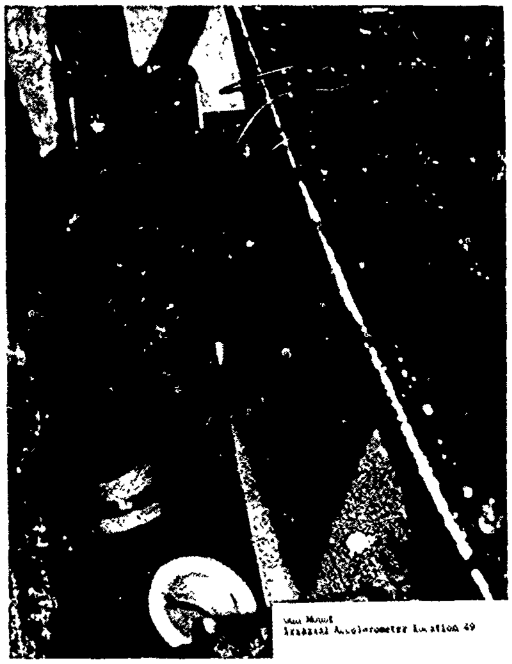
Engine Mount, Right
Triaxial Accelerometer Location 11
Triaxial Accelerometer Location 16
Thermocouple Location 8



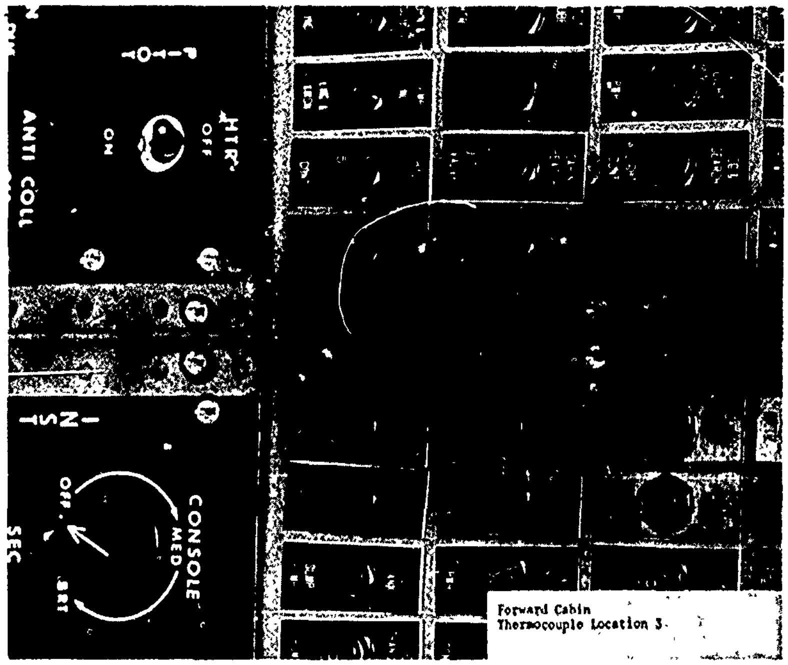
Left Fuel Boost Pump
Triaxial Accelerometer Location 45
Thermocouple Location 13



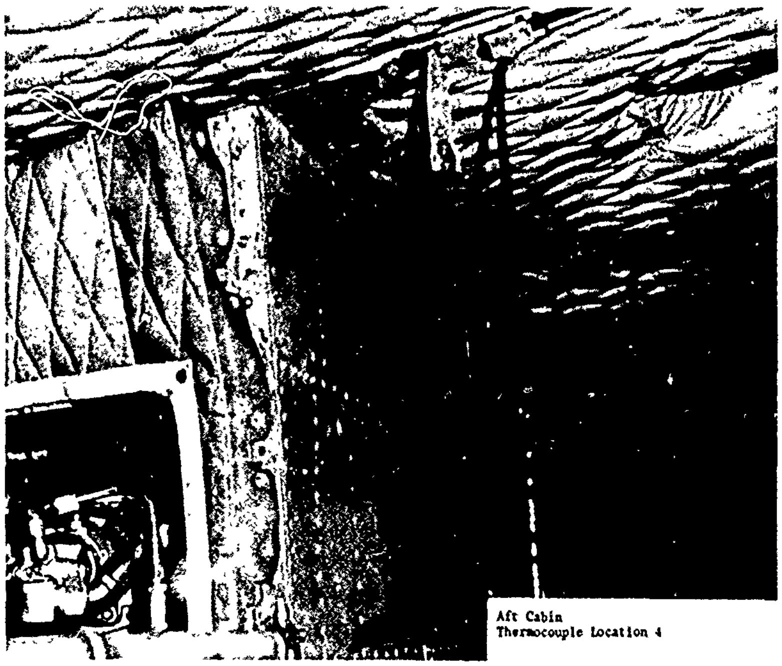
Engine
Triaxial Accelerometer Locations 47, 48
Thermocouple Location 7



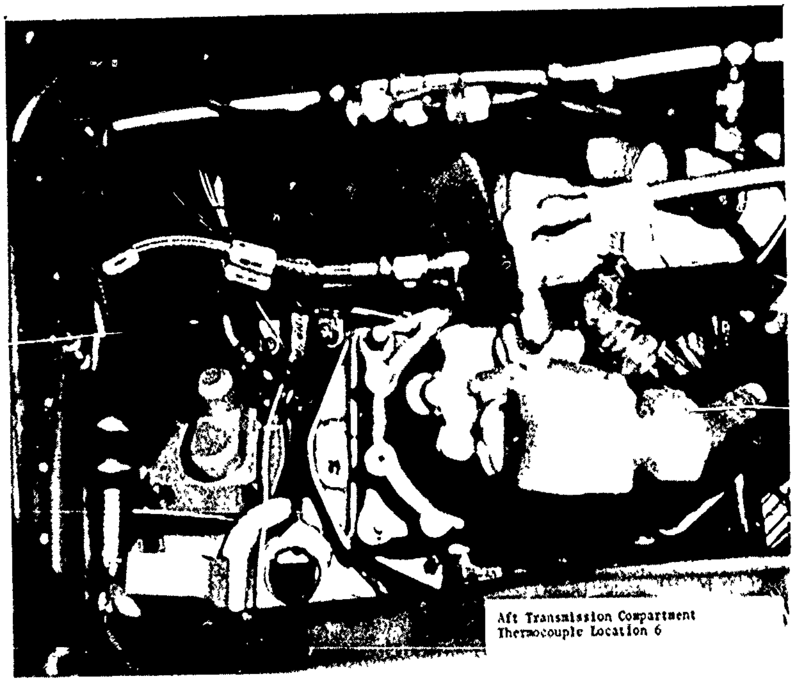
Van Mount
Triaxial Accelerometer Location 49



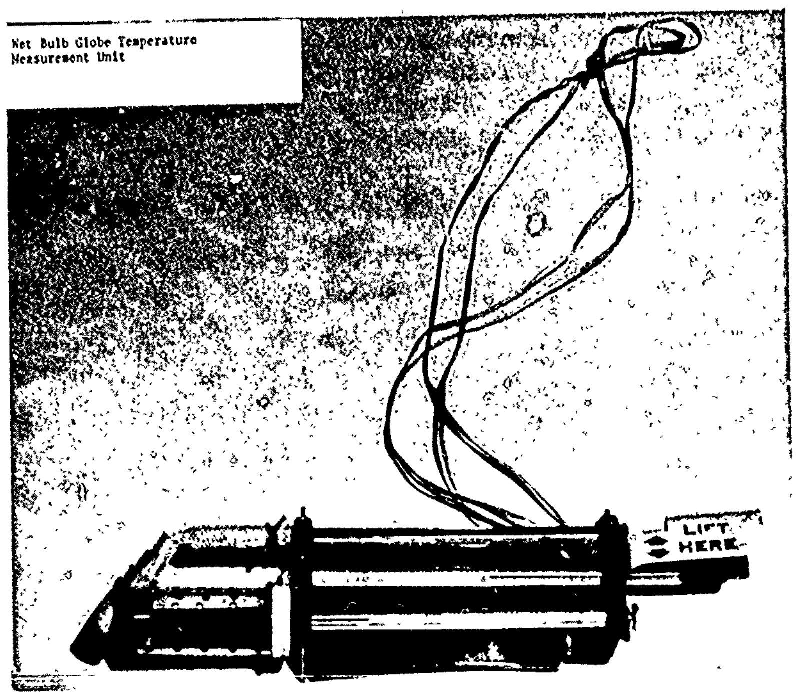
Forward Cabin
Thermocouple Location 3



Aft Cabin
Thermocouple Location 4



Aft Transmission Compartment
Thermocouple Location 6



Wet Bulb Globe Temperature
Measurement Unit

APPENDIX F. DATA REDUCTION METHODS

VIBRATION DATA

1. Because of the discrete frequency content of the data, a narrow-band spectral analysis was performed. A Spectral Dynamics 301 real-time spectral analyzer was utilized to perform the spectral analysis. This spectral analysis converted the data from the time domain (acceleration as a function of time) to the frequency domain (acceleration as a function of frequency). The output of the spectral analysis was a digital plot of acceleration versus frequency composed of acceleration values at 500 discrete frequencies uniformly spaced over the selected frequency range of the spectrum analyzer. The data were analyzed over two frequency ranges: zero to 500 Hz for instruments, avionics, and the pilot station, and zero to 2000 Hz for all other locations with resolution bandwidths of 1 Hz and 4 Hz, respectively. The zero-to-500-Hz analysis range was utilized for all instruments, avionics, and pilot station data, since there were no data of interest above 500 Hz, and the frequency resolution was better on the 500-Hz range than on the 2000-Hz range. The zero-to-2000-Hz analysis range was used for all other locations, since there were significant data above 500 Hz and the maximum instrumentation frequency response was 2000 Hz. Because of the random variation in amplitude, the data were averaged over a period of time to determine the mean acceleration amplitude for each test condition. This data averaging was accomplished with a Spectral Dynamics 302B ensemble averager. Data were averaged over an 8-second time interval for steady-state nonweapons-firing flight conditions, a 2-second interval for maneuvering flight, and a 2-second interval for weapons firing. The 2-second maneuvering flight analysis time interval was selected to cover the most severe vibrations encountered during the maneuver.

2. The following equations were used to calculate the acceleration mean and standard deviation values:

a. Mean ($\overline{X}$):

$$\overline{X} = \frac{\sum_{j=1}^{N} X_j}{N}$$

b. Standard deviation (S):

$$S = \sqrt{\frac{\sum_{j=1}^{N} \left(X_j - \overline{X}\right)^2}{N}}$$

c. Mean plus standard deviation (Y):

$$Y = \overline{X} + S$$

Where: X_j = acceleration at a specific frequency

N = number of records compressed

3. Figures 1 and 2 are block diagrams of the spectral analysis and data compression procedures.

TEMPERATURE DATA

4. The electrical analogue shown in figure 3 was developed to predict the temperature of the cabin and avionics under static conditions at values of ambient air temperature and external radiation different than those tested. The results of this analysis are presented in figures 136 through 144, appendix G.

FIGURE 1
PROJECT 70-15 VIBRATION DATA
SPECTRAL ANALYSIS PROCEDURE

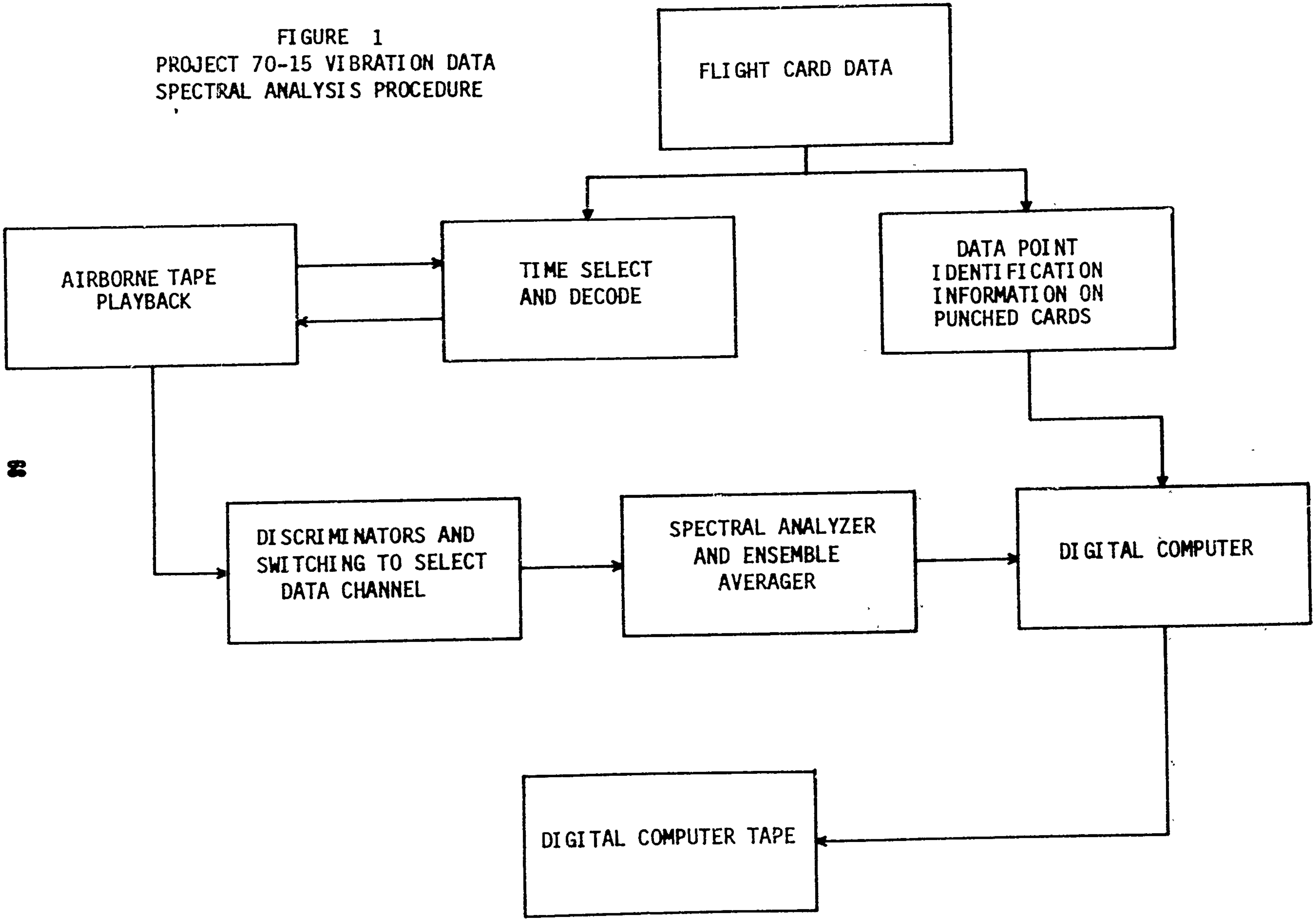
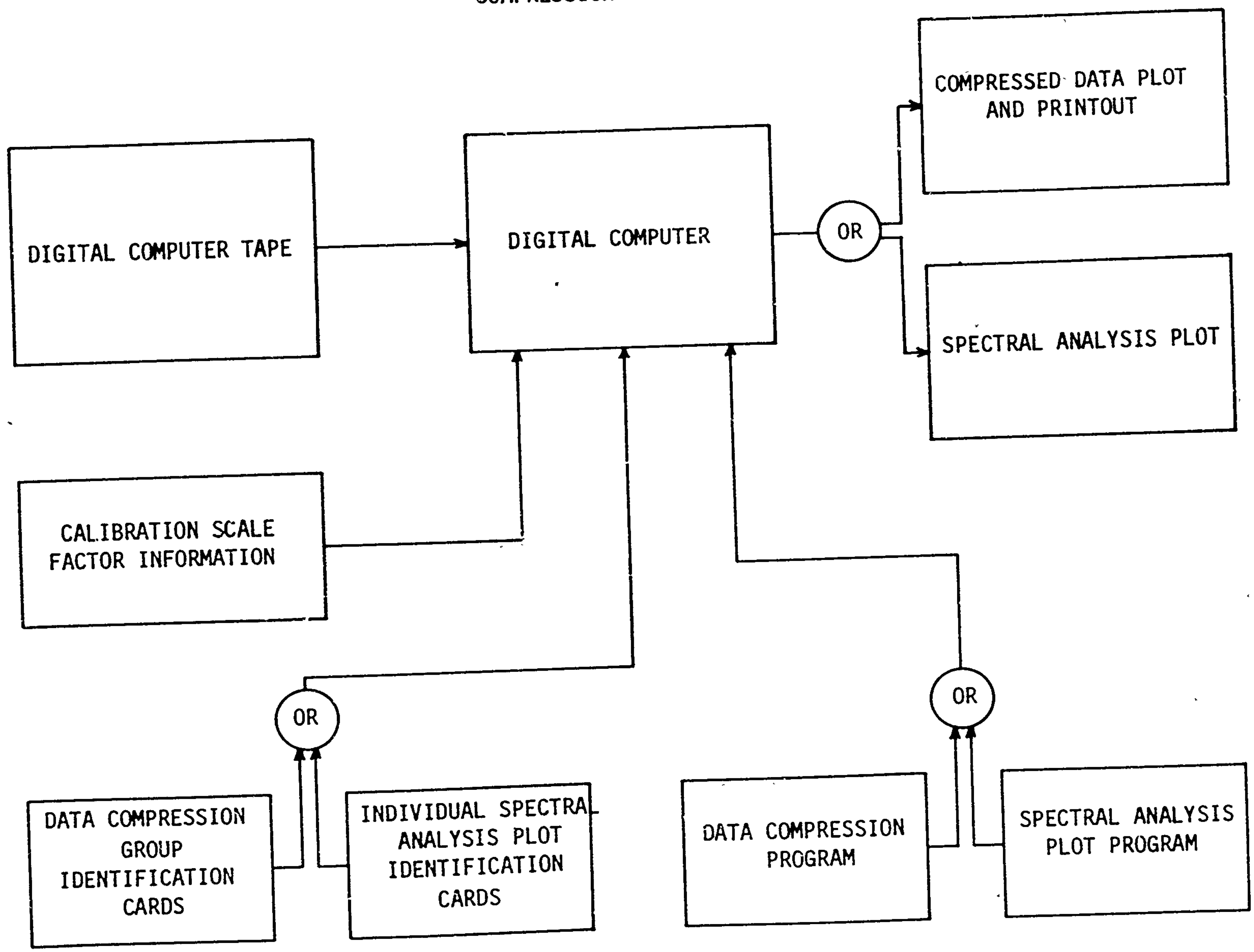


FIGURE 2
PROJECT 70-15 VIBRATION DATA
COMPRESSION PROCEDURE



ELECTRICAL QUANTITY	HEAT TRANSFER QUANTITY	UNIT (°K)
V ~ Voltage	T_a ~ Ambient air temperature	°K
V_c ~ Voltage across capacitor	T_c ~ Transient temperature inside helicopter	°K
	T_{ss} ~ Steady-state temperature inside helicopter	°K
	T_o ~ Initial temperature inside helicopter	°K
R_1 ~ Resistance	K_c ~ Conduction coefficient	Hr - °K/BTU
R_1 ~Resistance	K_r ~ Radiation heat transfer coefficient	Hr - °K/BTU
C ~ Capacitor	C ~ Heat capacity	BTU/°C
I ~ Current	E_{ex} ~ Total external radiation	BTU/hr
	E_a ~ Atmospheric radiation (total external radiation minus solar radiation)	BTU/hr
	F_s ~ Solar radiation	BTU/hr
t ~ Time	t ~ Time	Hr

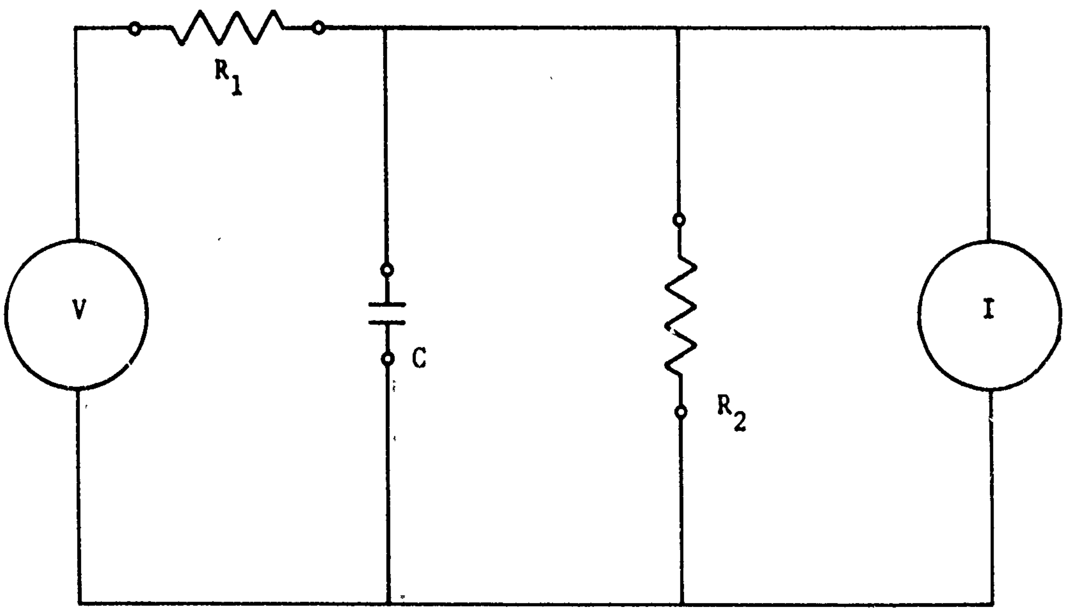


Figure 3. Heat Transfer Electrical Analog.

5. Using the circuit shown in figure 3, the equation describing the transient response of the helicopter to an ambient air temperature and source of external radiation can be written as:

$$T_c = e^{-t/K_{eq}C}\left[T_o - \frac{T_a K_r + E_{ex} K_c K_r}{K_c + K_r}\right] + \frac{T_a K_r + E_{ex} K_c K_r}{K_c + K_r} \quad (1)$$

Where: $$K_{eq} = \frac{K_c \; K_r}{K_c + K_r}$$

When t (time) → ∞ the steady-state helicopter temperature T_{ss} is given by:

Where: $$T_{ss} = \frac{T_a K_r + E_{ex} K_c K_r}{K + K} \quad (2)$$

$$E_{ex} = E_s + \sigma T_a^4$$

$$\sigma = 1.8 \times 10^{-8} \text{ BTU/ft}^2\text{-hour} - {}^\circ K^4$$

6. Equation 2 was used to find K_c and K_r by allowing the helicopter to reach its steady-state temperature at two different constant ambient air temperatures (T_{a1} and T_{a2}) and at two different external radiation values (E_{ex1} and E_{ex2}). This resulted in two equations with two unknowns, K_c and K_r, which were solved for K_c and K_r, equations 3 and 4.

$$K_c = \frac{T_{a_2} T_{ss_1} - T_{a_1} T_{ss_2}}{E_{ex_1} T_{ss_2} - E_{ex_2} T_{ss_1}} \quad (3)$$

$$K_r = \frac{T_{ss_1} \; K_c}{T_{a_1} + E_{ex_1} K_c - T_{ss_1}} \quad (4)$$

7. A different K_c and K_r were calculated for each temperature sensor location. Each location was considered to comprise an area of 1 square foot which enabled the measured external radiation value in units of BTU/ft^2-hr to be converted to BTU/hr. These values of K_c and K_r were then inserted into equation 2 in order to calculate the steady-state temperature at each temperature sensor location for different values of solar radiation and ambient air temperature than those tested (figs. 136 through 144, app G).

WET BULB GLOBE TEMPERATURE CALCULATION

8. The WBGT index is calculated from the following equation:

$$WBGT = 0.7WB + 0.2GT + 0.1DB$$

Where: WB = Naturally convected wet bulb temperature - °F

DB = Dry bulb temperature - °F

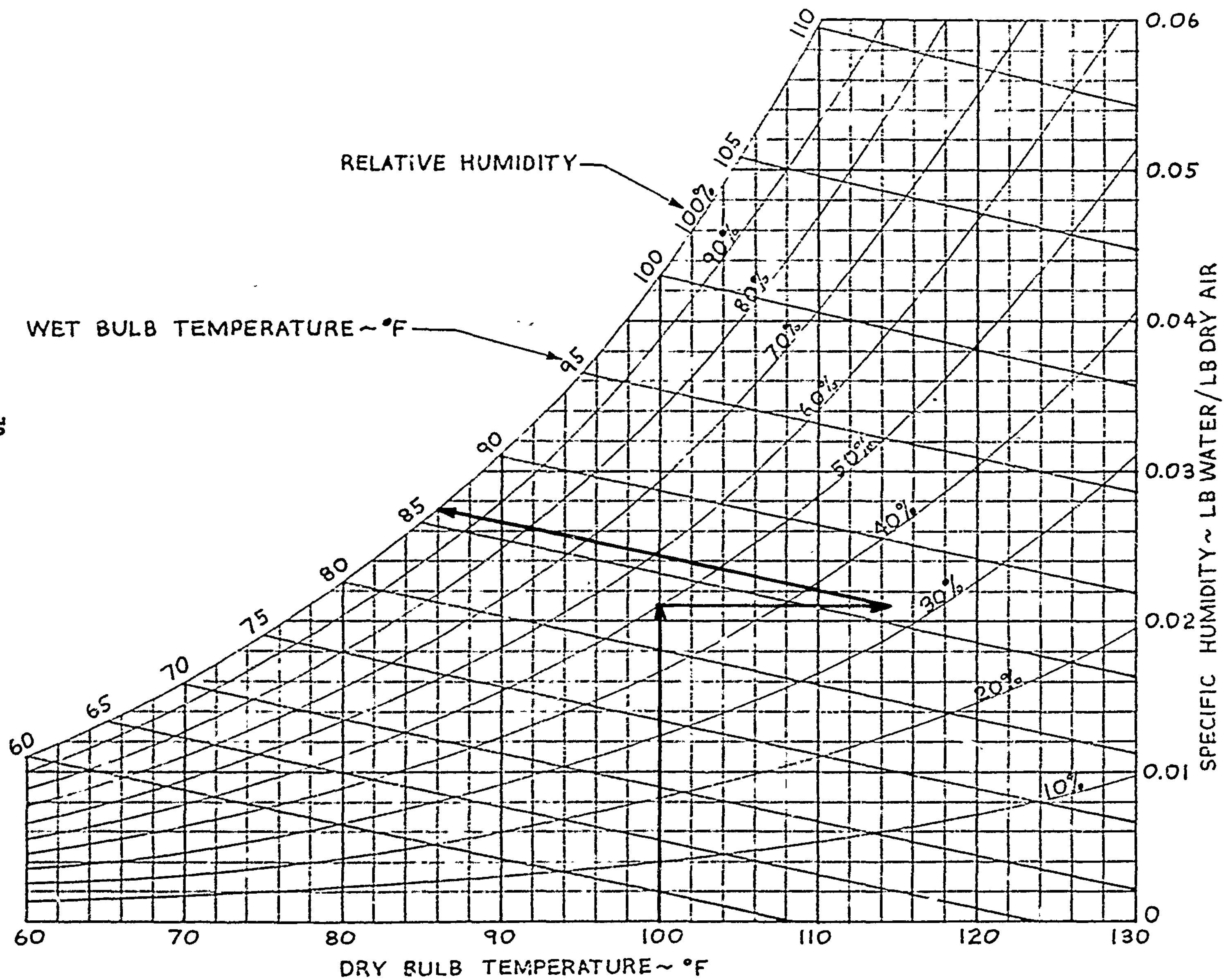
GT = Globe temperature - °F

For an outside air temperature of 100°F, a solar radiation value of 250 $BTU/hr\text{-}ft^2$ and an airspeed of 80 KCAS, a cabin temperature of 114.4°F and a globe temperature of 124.8°F can be determined from figure G. At a relative humidity of 50 percent at 100°F, a psychrometric chart can be used to determine a wet bulb temperature of 86.5°F for a cabin dry bulb temperature of 114.4°F. Using these temperature values, the WBGT can be calculated.

$$WBGT = (0.7)(86.5) + (0.2)(124.8) + (0.1)(114.4) = 97.0°F$$

PSYCHROMETRIC CHART

BAROMETRIC PRESSURE 29.92 IN. Hg



APPENDIX G. TEST DATA

Index

FIGURE I
FIRST PASS DATA COMPRESSION ARRAY
UH-1H USA S/N 67-17145

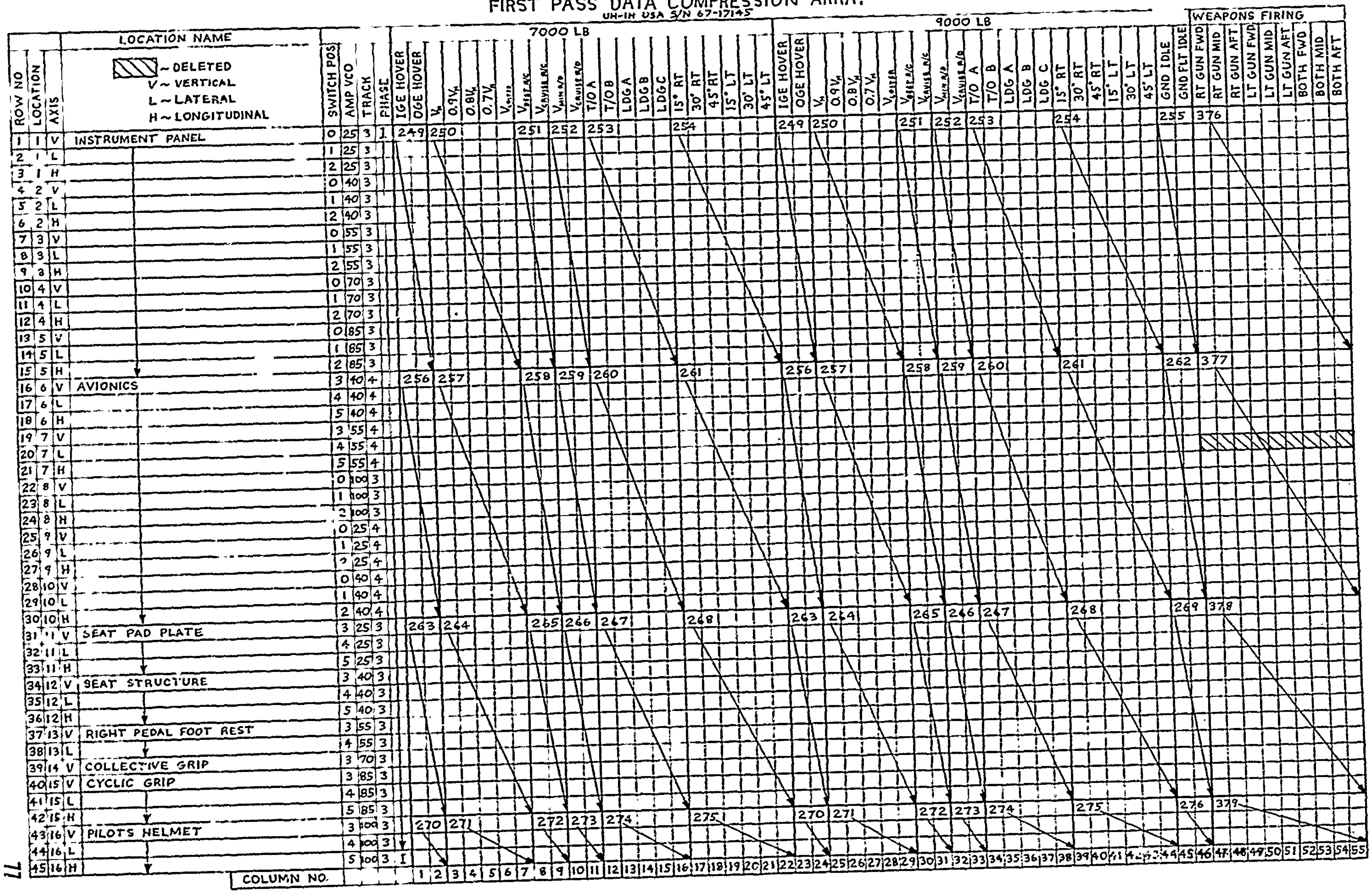


FIGURE 1
FIRST PASS DATA COMPRESSION ARRAY
UH-1H USA S/N 67-17145

ROW NO	LOCATION	AXIS	LOCATION NAME	SWITCH POS	AMP VCO	TRACK	PHASE	7000 LB: IGE HOVER (1)	OGE HOVER (2)	V_H (3)	0.9V_H (4)	0.8V_H (5)	0.7V_H (6)	V_{enter} (7)	$V_{best\,R/C}$ (8)	$V_{cruise\,R/C}$ (9)	$V_{min\,R/D}$ (10)	$V_{cruise\,R/D}$ (11)	T/O A (12)	T/O B (13)	LDG A (14)	LDG B (15)	LDG C (16)	15° RT (17)	30° RT (18)	45° RT (19)	15° LT (20)	30° LT (21)	45° LT (22)
46	17	V	BITE BLOCK	3	25	4	I	270		271					272		273		274					275					
47	17	L		4	25	4	I																						
48	17	H		5	25	4	I																						
49	18	V	TRANS MOUNT, LT FWD	0	25	3	II	277		278					279		280		281					282					
50	18	L		1	25	3																							
51	18	H		2	25	3																							
52	19	V	TRANS. MOUNT, RT FWD	3	25	3																							
53	19	L		4	25	3																							
54	19	H		5	25	3																							
55	20	V	TRANS MOUNT, LT AFT	0	100	4																							
56	20	L		1	100	4																							
57	20	H		2	100	4																							
58	21	V	TRANS MOUNT, RT AFT	3	100	4																							
59	21	L		4	100	4																							
60	21	H		5	100	4																							
61	22	V	TAIL BOOM ATTACH PT, UP LT	3	85	3		284		285					286		287		288					289					
62	22	L		4	85	3																							
63	22	H		5	85	3																							
64	23	V	TAIL BOOM ATTACH PT, LWR, RT	3	100	3																							
65	23	L		4	100	3																							
66	23	H		5	100	3																							
67	24	V	ENGINE DECK SEAM	3	25	4		291		292					293		294		295					296					
68	24	L		4	25	4																							
69	24	H		5	25	4																							
70	25	V	ENGINE DECK PANEL	3	40	4																							
71	25	L		4	40	4																							
72	25	H		5	40	4																							
73	26	V	ENGINE FIREWALL, LT SIDE	0	55	3		298		299					300		301		302					304					
74	26	L		1	55	3																							
75	26	H		2	55	3																							
76	27	V	ENGINE FIREWALL, CENTER	3	55	3																							
77	27	L		4	55	3																							
78	27	H		5	55	3																							
79	28	V	ENGINE MOUNT, LT FWD	0	85	3		306		307					308		309		310					311					
80	28	L		1	85	3																							
81	28	H		2	85	3																							
82	29	V	ENGINE MOUNT, LT AFT	0	100	3																							
83	29	L		1	100	3																							
84	29	H		2	100	3																							
85	44	V	ENGINE MOUNT, RT	0	25	4																							
86	44	L		1	25	4																							
87	44	H		2	25	4																							
88	30	V	TAIL ROTOR SERVO	0	40	4		313		314					315		316		317					318					
89	30	L		1	40	4																							
90	30	H		2	40	4	II																						

ROW NO	9000 LB: IGE HOVER (23)	OGE HOVER (24)	V_H (25)	0.9V_H (26)	0.8V_H (27)	0.7V_H (28)	V_{enter} (29)	$V_{best\,R/C}$ (30)	$V_{cruise\,R/C}$ (31)	$V_{min\,R/D}$ (32)	$V_{cruise\,R/D}$ (33)	T/O A (34)	T/O B (35)	LDG A (36)	LDG B (37)	LDG C (38)	15° RT (39)	30° RT (40)	45° RT (41)	15° LT (42)	30° LT (43)	45° LT (44)	GND IDLE (45)	GND FLT IDLE (46)	WEAPONS FIRING: RT GUN FWD (47)	RT GUN MID (48)	RT GUN AFT (49)	LT GUN FWD (50)	LT GUN MID (51)	UN AFT (52)	FWD (53)	OTH MID (54)	BOTH AFT (55)
46	270		271					272		273		274					275						276		379								
47																																	
48																																	
49	277		278					279		280		281					282						283		380								
50																																	
51																																	
52																																	
53																																	
54																																	
55																																	
56																																	
57																																	
58																																	
59																																	
60																																	
61	284		285					286		287		288					289						290		381								
62																																	
63																																	
64																																	
65																																	
66																																	
67	291		292					293		294		295					296						297		382								
68																																	
69																																	
70																																	
71																																	
72																																	
73	298		299					300		301		302					304						305		383								
74																																	
75																																	
76																																	
77																																	
78																																	
79	306		307					308		309		310					311						312		384								
80																																	
81																																	
82																																	
83																																	
84																																	
85																																	
86																																	
87																																	
88	313		314					315		316		317					318						319		385								
89																																	
90																																	

COLUMN NO.

FIGURE 1
FIRST PASS DATA COMPRESSION ARRAY
UH-1H USA S/N 67-17145

			LOCATION NAME					7000 LB																						9000 LB																								WEAPONS FIRING								
ROW NO	LOCATION	AXIS		SWITCH POS	AMP VCO	TRACK	PHASE	IGE HOVER	OGE HOVER	V_H	$0.9V_H$	$0.8V_H$	$0.7V_H$	V_{COTTER}	$V_{BEST\ R/C}$	$V_{CRUISE\ R/C}$	$V_{MIN\ R/D}$	$V_{CRUISE\ R/D}$	T/O A	T/O B	LDG A	LDG B	LDG C	15° RT	30° RT	45° RT	15° LT	30° LT	45° LT	IGE HOVER	OGE HOVER	V_H	$0.9V_H$	$0.8V_H$	$0.7V_H$	V_{COTTER}	$V_{BEST\ R/C}$	$V_{CRUISE\ R/C}$	$V_{MIN\ R/D}$	$V_{CRUISE\ R/D}$	T/O A	T/O B	LDG A	LDG B	LDG C	15° RT	30° RT	45° RT	15° LT	30° LT	45° LT	GND IDLE	GND FLT IDLE	RT GUN FWD	RT GUN MID	RT GUN AFT	LT GUN FWD	LT GUN MID	LT GUN AFT	BOTH FWD	BOTH MID	BOTH AFT
91	31	V	OIL COOLER	0	55	4	II	320		321					322		323		324					325						320		321					322		323		324					325						326		386								
92	31	L		1	55	4	II																																																							
93	31	H		2	55	4	II																																																							
94	32	V	TAIL ROTOR SHAFT 42° GEARBOX	3	85	4	I	327		328					329		330		331					332						327		328					329		330		331					332						333		387								
95	32	L		4	85	4	I																																																						
96	32	H		5	85	4	I																																																						
97	33	V	TAIL ROTOR SHAFT 90° GEARBOX	0	85	4	II																																																						
98	33	L		1	85	4																																																							
99	33	H		2	85	4																																																							
100	34	V	HYDRAULIC SERVO	3	55	4		334		335					336		337		338					339						334		335					336		337		338					339						340		388								
101	34	L		4	55	4																																																							
102	34	H		5	85	4																																																							
103	35	V	FUEL BOOST PUMP, RT	3	40	3		341		342					343		344		345					346						341		342					343		344		345					346						347		389								
104	35	L		4	40	3																																																							
105	35	H		5	40	3																																																							
106	45	V	FUEL BOOST PUMP, LT	0	40	3																																																							
107	45	L		1	40	3																																																							
108	45	H		2	40	3	II																																																						
109	36	V	GAS PRODUCER TACH GENERATOR	0	85	4	I	348		349					350		351		352					353						348		349					350		351		352					353						354		390								
110	36	L		1	85	4																																																							
111	36	H		2	85	4																																																							
112	37	V	MAIN ROTOR TACH GENERATOR	0	100	4																																																							
113	37	L		1	100	4																																																							
114	37	H		2	100	4																																																							
115	38	V	POWER TURBINE TACH GENERATOR	3	100	4																																																							
116	38	L		4	100	4																																																							
117	38	H		5	100	4																																																							
118	39	V	HANGER BEARING NO. 1	6	85	4		355		356					357		358		359					360						355		356					357		358		359					360						361		391								
119	39	L		7	85	4																																																							
120	40	V	HANGER BEARING NO. 2	6	100	4																																																							
121	40	L		7	100	4	I																																																						
122	41	V	HANGER BEARING NO. 3		25	3	II																																																						
123	41	L		7	25	3																																																							
124	42	V	HANGER BEARING NO. 4	6	100	4																																																							
125	42	L		7	100	4	II																																																						
126	43	V	LIFT LINK	0	70	4	I, II	394		395					396		397		398					399						394		395					396		397		398					399						400		401								
127	43	L		1	70	4																																																							
128	43	H		2	70	4																																																							
129	43	V		3	70	4																																																							
130	43	L		4	70	4																																																							
131	43	H		5	70	4																																																							
132	43	V		6	70	4																																																							
133	43	L		7	70	4	I, II																																																						
134	46	V	ENGINE, AFT	0	70	3	II	362		363					364		365		366					367						362		363					364		365		366					367						368		392								
135	46	L		1	70	3	II																																																						
			COLUMN NO.					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55

FIGURE 1
FIRST PASS DATA COMPRESSION ARRAY
UH-1H USA S/N 67-17145

ROW NO	LOCATION	AXIS	LOCATION NAME	SWITCH POS	AMP VCO	TRACK	PHASE
136	46	H	EN[illegible] AFT	2	70	3	II
137	47	V	ENGINE, FRONT	3	70	3	
138	47	L		4	70	3	
139	47	H		5	70	3	
140	48	V	ENGINE, MID	6	70	3	
141	48	L		6	85	4	
142	48	H		7	85	4	
143	49	V	GUN MOUNT	3	85	4	
144	49	L		4	85	4	
145	49	H		5	85	4	II

7000 LB

ROW NO	IGE HOVER	OGE HOVER	V_H	$0.9V_H$	$0.8V_H$	$0.7V_H$	V_{LOITER}	$V_{BEST\ R/C}$	$V_{CRUISE\ R/C}$	$V_{MIN\ R/D}$	$V_{CRUISE\ R/D}$	T/O A	T/O B	LDG A	LDG B	LDG C	15° RT	30° RT	45° RT	15° LT	30° LT	45° LT
COLUMN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
136	362		363					364		365		366					367					

9000 LB

ROW NO	IGE HOVER	OGE HOVER	V_H	$0.9V_H$	$0.8V_H$	$0.7V_H$	V_{LOITER}	$V_{BEST\ R/C}$	$V_{CRUISE\ R/C}$	$V_{MIN\ R/D}$	$V_{CRUISE\ R/D}$	T/O A	T/O B	LDG A	LDG B	LDG C	15° RT	30° RT	45° RT	15° LT	30° LT	45° LT	GND IDLE	GND FLT IDLE
COLUMN NO.	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
136	362		363					364		365		366					367						368	

WEAPONS FIRING

ROW NO	RT GUN FWD	RT GUN MID	RT GUN AFT	LT GUN FWD	LT GUN MID	LT GUN AFT	BOTH FWD	BOTH MID	BOTH AFT
COLUMN NO.	47	48	49	50	51	52	53	54	55
136	392								
143	393								

FIGURE 2
SECOND PASS DATA COMPRESSION ARRAY
UH-1H USA S/N 67-17145

LOCATION NAME: ~ DELETED; V ~ VERTICAL; L ~ LATERAL; H ~ LONGITUDINAL

ROW NO	LOCATION	AXIS	LOCATION NAME	SWITCH POS	AMP V/O	TRACK	PHASE	7000 LB																						9000 LB																								WEAPONS FIRING								
								IGE HOVER	OGE HOVER	V_H	$0.9V_H$	$0.8V_H$	$0.7V_H$	V_{LOITER}	$V_{BEST\ R/C}$	$V_{CRUISE\ R/C}$	$V_{MIN\ R/D}$	$V_{CRUISE\ R/D}$	T/O A	T/O B	LDG A	LDG B	LDG C	15° RT	30° RT	45° RT	15° LT	30° LT	45° LT	IGE HOVER	OGE HOVER	V_H	$0.9V_H$	$0.8V_H$	$0.7V_H$	V_{LOITER}	$V_{BEST\ R/C}$	$V_{CRUISE\ R/C}$	$V_{MIN\ R/D}$	$V_{CRUISE\ R/D}$	T/O A	T/O B	LDG A	LDG B	LDG C	15° RT	30° RT	45° RT	15° LT	30° LT	45° LT	GND IDLE	GND FLT IDLE	RT GUN FWD	RT GUN MID	RT GUN AFT	LT GUN FWD	LT GUN MID	LT GUN AFT	BOTH FWD	BOTH MID	BOTH AFT
1	1	V	INSTRUMENT PANEL	0	25	3	I	402																																																						
2	1	L		1	25	3																																																								
3	1	H		2	25	3																																																								
4	2	V		0	40	3																																																								
5	2	L		1	40	3																																																								
6	2	H		2	40	3																																																								
7	3	V		0	55	3																																																								
8	3	L		1	55	3																																																								
9	3	H		2	55	3																																																								
10	4	V		0	70	3																																																								
11	4	L		1	70	3																																																								
12	4	H		2	70	3																																																								
13	5	V		0	85	3																																																								
14	5	L		1	85	3																																																								
15	5	H		2	85	3																																																								
16	6	V	AVIONICS	3	40	4		403																																																						
17	6	L		4	40	4																																																								
18	6	H		5	40	4																																																								
19	7	V		3	55	4																																																								
20	7	L		4	55	4																																																								
21	7	H		5	55	4																																																								
22	8	V		0	100	4																																																								
23	8	L		1	100	4																																																								
24	8	H		2	100	4																																																								
25	9	V		0	25	4																																																								
26	9	L		1	25	4																																																								
27	9	H		2	25	4																																																								
28	10	V		0	40	4																																																								
29	10	L		1	40	4																																																								
30	10	H		2	40	4																																																								
31	11	V	SEAT PAD PLATE	3	25	3		404																																																						
32	11	L		4	25	3																																																								
33	11	H		5	25	3																																																								
34	12	V	SEAT STRUCTURE	3	40	3																																																								
35	12	L		4	40	3																																																								
36	12	H		5	40	3																																																								
37	13	V	RIGHT PEDAL FOOT REST	3	55	3																																																								
38	13	L		4	55	3																																																								
39	14	V	COLLECTIVE GRIP	3	70	3																																																								
40	15	V	CYCLIC GRIP	3	85	3																																																								
41	15	L		4	85	3																																																								
42	15	H		5	85	3																																																								
43	16	V	PILOTS HELMET	3	100	3		405																																																						
44	16	L		4	100	3																																																								
45	16	H		5	100	3	I																																																							
			COLUMN NO.					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55

NOTE: NO SECOND PASS WEAPONS FIRING COMPRESSIONS CALCULATED

FIGURE 2
SECOND PASS DATA COMPRESSION ARRAY
UH-1H USA S/N 67-17145

ROW NO	LOCATION	AXIS	LOCATION NAME	SWITCH POS	AMP VCO	TRACK	PHASE	7000 LB: IGE HOVER (1)	OGE HOVER (2)
46	17	V	BITE BLOCK	3	25	4	I	405	
47	17	L		4	25	4	I		
48	17	H		5	25	4	I		
49	18	V	TRANS MOUNT, LT FWD	0	25	3	II	406	
50	18	L		1	25	3			
51	18	H		2	25	3			
52	19	V	TRANS MOUNT, LT AFT	3	25	3			
53	19	L		4	25	3			
54	19	H		5	25	3			
55	20	V	TRANS MOUNT, LT AFT	0	100	4			
56	20	L		1	100	4			
57	20	H		2	100	4			
58	21	V	TRANS MOUNT, RT AFT	3	100	4			
59	21	L		4	100	4			
60	21	H		5	100	4			
61	22	V	TAIL BOOM ATTACH PT, UP LT	3	85	3		407	
62	22	L		4	85	3			
63	22	H		5	85	3			
64	23	V	TAIL BOOM ATTACH PT. LWR RT	3	100	3			
65	23	L		4	100	3			
66	23	H		5	100	3			
67	24	V	ENGINE DECK SEAM	3	25	4		408	
68	24	L		4	25	4			
69	24	H		5	25	4			
70	25	V	ENGINE DECK PANEL	3	40	4			
71	25	L		4	40	4			
72	25	H		5	40	4			
73	26	V	ENGINE FIREWALL, LT SIDE	0	55	3		409	
74	26	L		1	55	3			
75	26	H		2	55	3			
76	27	V	ENGINE FIREWALL, CENTER	3	55	3			
77	27	L		4	55	3			
78	27	H		5	55	3			
79	28	V	ENGINE MOUNT, LT FWD	0	85	3		410	
80	28	L		1	85	3			
81	28	H		2	85	3			
82	29	V	ENGINE MOUNT, LT AFT	0	100	3			
83	29	L		1	100	3			
84	29	H		2	100	3			
85	44	V	ENGINE MOUNT, RT	0	25	4			
86	44	L		1	25	4			
87	44	H		2	25	4			
88	30	V	TAIL ROTOR SERVO	0	40	4		411	
89	30	L		1	40	4			
90	30	H		2	40	4	II		

COLUMN NO.	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
7000 LB	V_H	$0.9V_H$	$0.8V_H$	$0.7V_H$	$V_{[illegible]}$	$V_{BEST\ R/C}$	$V_{CRUISE\ R/C}$	$V_{MIN\ R/D}$	$V_{CRUISE\ R/D}$	T/O A	T/O B	LDG A	LDG B	LDG C	15° RT	30° RT	45° RT	15° LT	30° LT	45° LT

COLUMN NO.	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
9000 LB	IGE HOVER	OGE HOVER	V_H	$0.9V_H$	$0.8V_H$	$0.7V_H$	$V_{[illegible]}$	$V_{BEST\ R/C}$	$V_{CRUISE\ R/C}$	$V_{MIN\ R/D}$	$V_{CRUISE\ R/D}$	T/O A	T/O B	LDG A	LDG B	LDG C	15° RT	30° RT	45° RT	15° LT	30° LT	45° LT	GND IDLE	GND FLT IDLE

COLUMN NO.	47	48	49	50	51	52	53	54	55
WEAPONS FIRING	RT GUN FWD	RT GUN MID	RT GUN AFT	LT GUN FWD	LT GUN MID	LT GUN AFT	BOTH FWD	BOTH MID	BOTH AFT

FIGURE 2

SECOND PASS DATA COMPRESSION ARRAY

UH-1H USA S/N 67-17145

ROW NO	LOCATION	AXIS	LOCATION NAME	SWITCH POS	AMP VCO	TRACK	PHASE	IGE HOVER	OGE HOVER	V_H	$0.9V_H$	$0.8V_H$	$0.7V_H$	V_{LOITER}	$V_{BEST R/C}$	$V_{CRUISE R/C}$	$V_{MIN R/D}$	$V_{CRUISE R/D}$	T/O A	T/O B	LDG A	LDG B	LDG C	15° RT	30° RT	45° RT	15° LT	30° LT	45° LT	IGE HOVER	OGE HOVER	V_H	$0.9V_H$	$0.8V_H$	$0.7V_H$	V_{LOITER}	$V_{BEST R/C}$	$V_{CRUISE R/C}$	$V_{MIN R/D}$	$V_{CRUISE R/D}$	T/O A	T/O B	LDG A	LDG B	LDG C	15° RT	30° RT	45° RT	15° LT	30° LT	45° LT	GND IDLE	GND FLT IDLE	RT GUN FWD	RT GUN MID	RT GUN AFT	LT GUN FWD	LT GUN MID	LT GUN AFT	BOTH FWD	BOTH MID	BOTH AFT
								7000 LB																						9000 LB																								WEAPONS FIRING								
91	31	V	OIL COOLER	0	55	4	II	412																																																						
92	31	L		1	55	4	II																																																							
93	31	H		2	55	4	II																																																							
94	32	V	TAIL ROTOR SHAFT 42° GEARBOX	3	85	4	I	413																																																						
95	32	L		4	85	4	I																																																							
96	32	H		5	85	4	I																																																							
97	33	V	TAIL ROTOR SHAFT 90° GEARBOX	0	85	4	II																																																							
98	33	L		1	85	4																																																								
99	33	H		2	85	4																																																								
100	34	V	HYDRAULIC SERVO	3	C5	4		414																																																						
101	34	L		4	55	4																																																								
102	34	H		5	55	4																																																								
103	35	V	FUEL BOOST PUMP, RT	3	40	3		415																																																						
104	35	L		4	40	3																																																								
105	35	H		5	40	3																																																								
106	45	V	FUEL BOOST PUMP, LT	0	40	3																																																								
107	45	L		1	40	3	II																																																							
108	45	H		2	40	3	I																																																							
109	36	V	GAS PRODUCER TACH GENERATOR	0	85	4		416																																																						
110	36	L		1	85	4																																																								
111	36	H		2	85	4																																																								
112	37	V	MAIN ROTOR TACH GENERATOR	0	100	4																																																								
113	37	L		1	100	4																																																								
114	37	H		2	100	4																																																								
115	38	V	POWER TURBINE TACH GENERATOR	3	100	4																																																								
116	38	L		4	100	4																																																								
117	38	H		5	100	4																																																								
118	37	V	HANGER BEARING NO. 1	6	85	4		417																																																						
119	37	L		7	85	4																																																								
120	40	V	HANGER BEARING NO 2	6	100	4	I																																																							
121	40	L		7	100	4	II																																																							
122	41	V	HANGER BEARING NO 3	6	25	3																																																								
123	41	L		7	25	3																																																								
124	42	V	HANGER BEARING NO. 4	6	100	4																																																								
125	42	L		7	100	4	II																																																							
126	43	V	LIFT LINK	0	70	4	I,II	418																																																					
127	43	L		1	70	4																																																								
128	43	H		2	70	4																																																								
129	43	V		3	70	4																																																								
130	43	L		4	70	4																																																								
131	43	H		5	70	4																																																								
132	43	V		6	70	4																																																								
133	43	L		7	70	4	I,II																																																							
134	46	V	ENGINE, AFT	0	70	3	II	419																																																					
135	46	L		1	70	3	II																																																							
			COLUMN NO.					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55

FIGURE 2
SECOND PASS DATA COMPRESSION ARRAY
UH-1H USA S/N 67-17145

ROW NO	LOCATION	AXIS	LOCATION NAME	SWITCH POS	AMP VCO	TRACK	PHASE	7000 LB																						9000 LB																								WEAPONS FIRING								
								IGE HOVER	OGE HOVER	V_H	$0.9V_H$	$0.8V_H$	$0.7V_H$	V_{entry}	$V_{BEST R/C}$	$V_{CRUISE R/C}$	$V_{MIN R/D}$	$V_{CRUISE R/D}$	T/O A	T/O B	LDG A	LDG B	LDG C	15° RT	30° RT	45° RT	15° LT	30° LT	45° LT	IGE HOVER	OGE HOVER	V_H	$0.9V_H$	$0.8V_H$	$0.7V_H$	V_{entry}	$V_{BEST R/C}$	$V_{CRUISE R/C}$	$V_{MIN R/D}$	$V_{CRUISE R/D}$	T/O A	T/O B	LDG A	LDG B	LDG C	15° RT	30° RT	45° RT	15° LT	30° LT	45° LT	GND IDLE	GND FLT IDLE	RT GUN FWD	RT GUN MID	RT GUN AFT	LT GUN FWD	LT GUN MID	LT GUN AFT	BOTH FWD	BOTH MID	BOTH AFT
136	46	H	ENGINE, AFT	2	70	3	II	419																																																						
137	47	V	ENGINE, FRONT	3	70	3																																																								
138	47	L		4	70	3																																																								
139	47	H		5	70	3																																																								
140	48	V	ENGINE, MID	6	70	3																																																								
141	48	L		6	85	4																																																								
142	48	H		7	85	4	II																																																								
			COLUMN NO.					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55

FIGURE 3

THIRD PASS DATA COMPRESSION ARRAY

UH-1H USA S/N 67-17145

PAGE 1 OF 1

LOCATION NAME

~ DELETED
V ~ VERTICAL
L ~ LATERAL
H ~ LONGITUDINAL

ROW NO	LOCATION	AXIS	LOCATION NAME	SWITCH POS	AMP VCO	TRACK	PHASE
1	1	V	INSTRUMENT PANEL	0	25	3	I
2	1	L		1	25	3	
3	1	H		2	25	3	
4	2	V		0	40	3	
5	2	L		1	40	3	
6	2	H		2	40	3	
7	3	V		0	55	3	
8	3	L		1	55	3	
9	[illegible]	H		2	55	3	
10	[illegible]	V		0	70	3	
11	4	L		1	70	3	
12	4	H		2	70	3	
13	5	V		0	85	3	
14	5	L		1	85	3	
15	5	H		2	85	3	
16	6	V	AVIONICS	3	40	4	
17	6	L		4	40	4	
18	6	H		5	40	4	
19	7	V		3	55	4	
20	7	L		4	55	4	
21	7	H		5	55	4	
22	8	V		0	100	4	
23	8	L		1	100	4	
24	8	H		2	100	4	
25	9	V		0	25	4	
26	9	L		1	25	4	
27	9	H		2	25	4	
28	10	V		0	40	4	
29	10	L		1	40	4	
30	10	H		2	40	4	I

7000 LB

ROW NO	IGE HOVER	OGE HOVER	V_H	$0.9V_H$	$0.8V_H$	$0.7V_H$	V_{LOITER}	$V_{BEST\ R/C}$	$V_{CRUISE\ R/C}$	$V_{MIN\ R/D}$	$V_{CRUISE\ R/D}$	T/O A	T/O B	LDG A	LDG B	LDG C	15° RT	30° RT	45° RT	15° LT	30° LT	45° LT
1	436																					
2																						
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
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24																						
25																						
26																						
27																						
28																						
29																						
30																						
COLUMN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

9000 LB / WEAPONS FIRING

ROW NO	IGE HOVER	OGE HOVER	V_H	$0.9V_H$	$0.8V_H$	$0.7V_H$	V_{LOITER}	$V_{BEST\ R/C}$	$V_{CRUISE\ R/C}$	$V_{MIN\ R/D}$	$V_{CRUISE\ R/D}$	T/O A	T/O B	LDG A	LDG B	LDG C	15° RT	30° RT	45° RT	15° LT	30° LT	45° LT	GND IDLE	GND FLT IDLE	RT GUN FWD	RT GUN MID	RT GUN AFT	LT GUN FWD	LT GUN MID	LT GUN AFT	BOTH FWD	BOTH MID	BOTH AFT
1																									437								
2																																	
3																																	
4																																	
5																																	
6																																	
7																																	
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28																																	
29																																	
30																																	
COLUMN NO.	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55

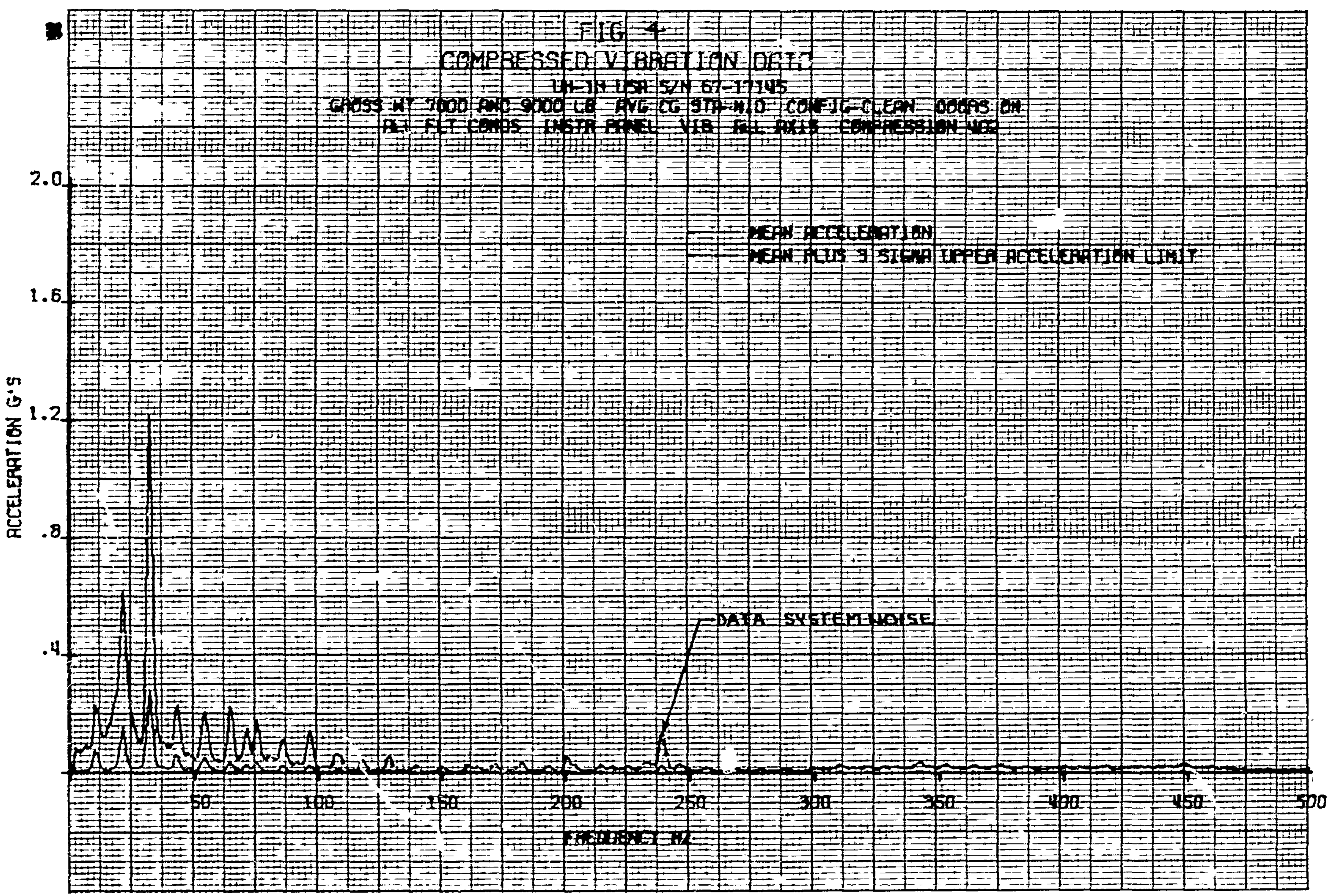


FIG 4
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS ON
ALL FLT CONDS INSTR PANEL VIB ALL AXIS COMPRESSION NO2
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

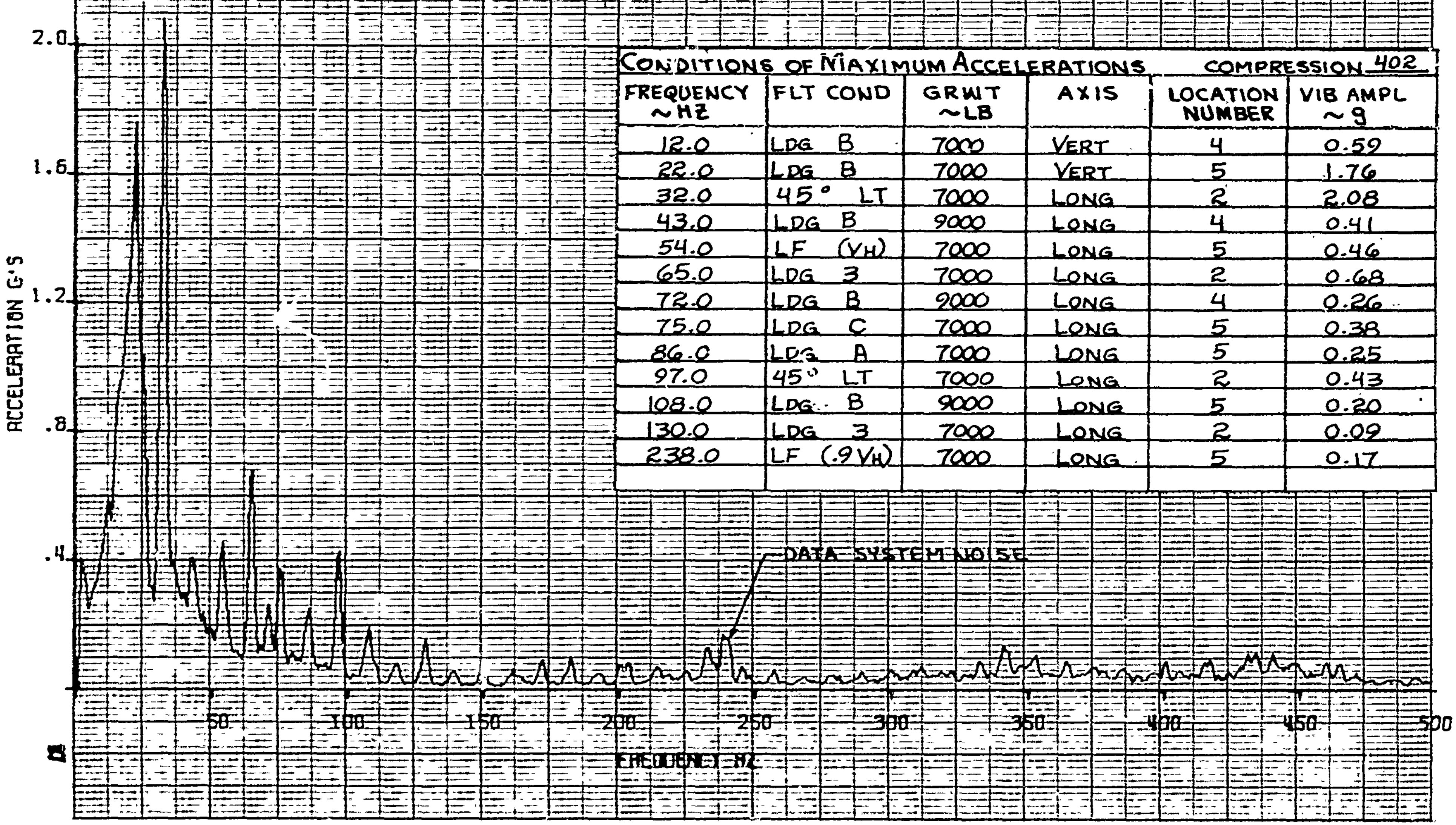
FIG 5

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

[illegible] USA S/N 67-17145

GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS ON

ALL FLT CONDS INSTR PANEL VIB ALL AXIS COMPRESSION 402



CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 402

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
12.0	LDG B	7000	VERT	4	0.59
22.0	LDG B	7000	VERT	5	1.76
32.0	45° LT	7000	LONG	2	2.08
43.0	LDG B	9000	LONG	4	0.41
54.0	LF (VH)	7000	LONG	5	0.46
65.0	LDG 3	7000	LONG	2	0.68
72.0	LDG B	9000	LONG	4	0.26
75.0	LDG C	7000	LONG	5	0.38
86.0	LDG A	7000	LONG	5	0.25
97.0	45° LT	7000	LONG	2	0.43
108.0	LDG B	9000	LONG	5	0.20
130.0	LDG 3	7000	LONG	2	0.09
238.0	LF (.9VH)	7000	LONG	5	0.17

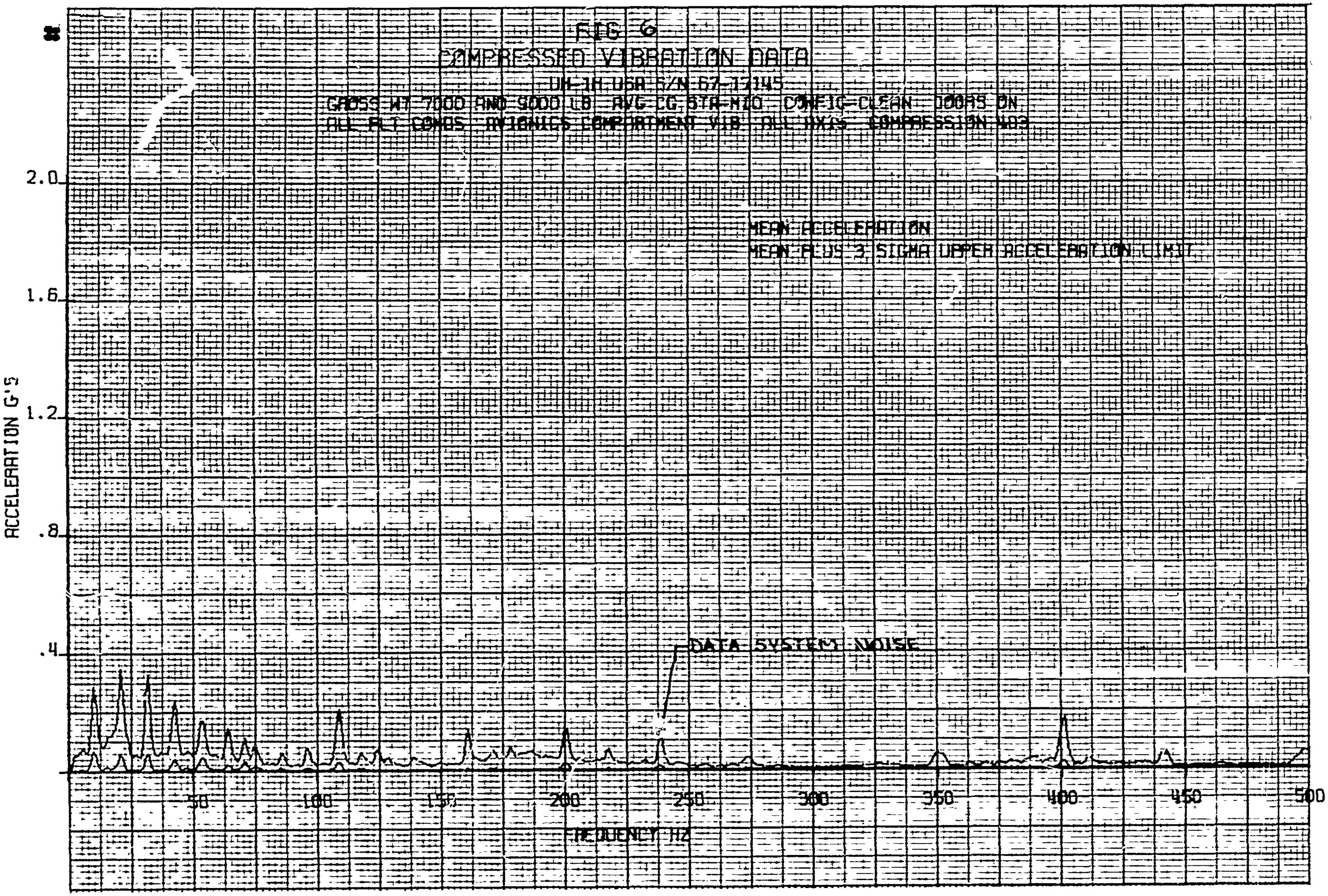


FIG 6
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS ON
ALL FLT CONDS AVIONICS COMPARTMENT VIB ALL AXES COMPRESSION 403
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

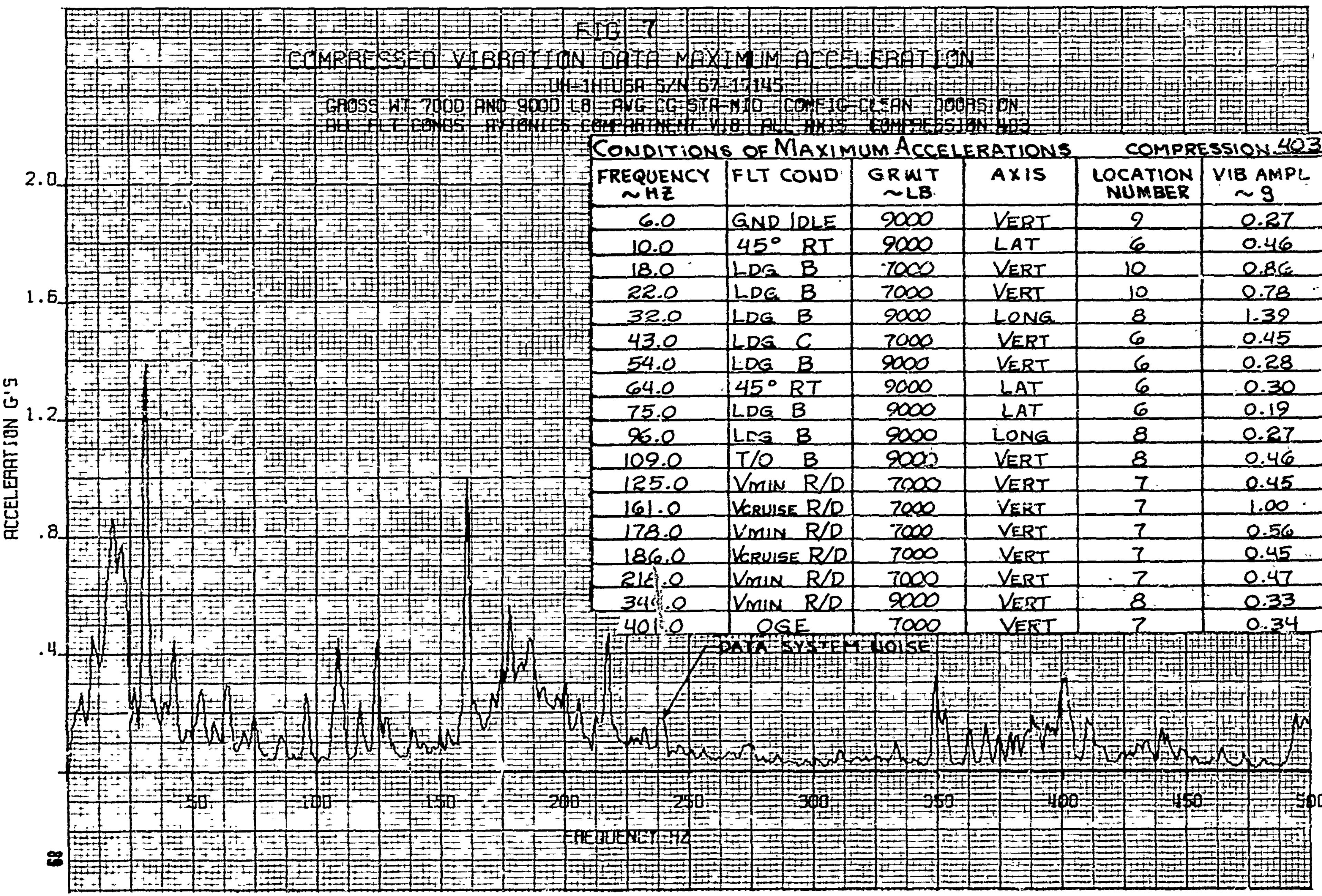
FIG 7

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS ON

ALL FLT CONDS AVIONICS COMPARTMENT VIB ALL AXIS COMPRESSION 403



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 403

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
6.0	GND IDLE	9000	VERT	9	0.27
10.0	45° RT	9000	LAT	6	0.46
18.0	LDG B	7000	VERT	10	0.86
22.0	LDG B	7000	VERT	10	0.78
32.0	LDG B	9000	LONG	8	1.39
43.0	LDG C	7000	VERT	6	0.45
54.0	LDG B	9000	VERT	6	0.28
64.0	45° RT	9000	LAT	6	0.30
75.0	LDG B	9000	LAT	6	0.19
96.0	LDG B	9000	LONG	8	0.27
109.0	T/O B	9000	VERT	8	0.46
125.0	V_{MIN} R/D	7000	VERT	7	0.45
161.0	V_{CRUISE} R/D	7000	VERT	7	1.00
178.0	V_{MIN} R/D	7000	VERT	7	0.56
186.0	V_{CRUISE} R/D	7000	VERT	7	0.45
216.0	V_{MIN} R/D	7000	VERT	7	0.47
346.0	V_{MIN} R/D	9000	VERT	8	0.33
401.0	OGE	7000	VERT	7	0.34

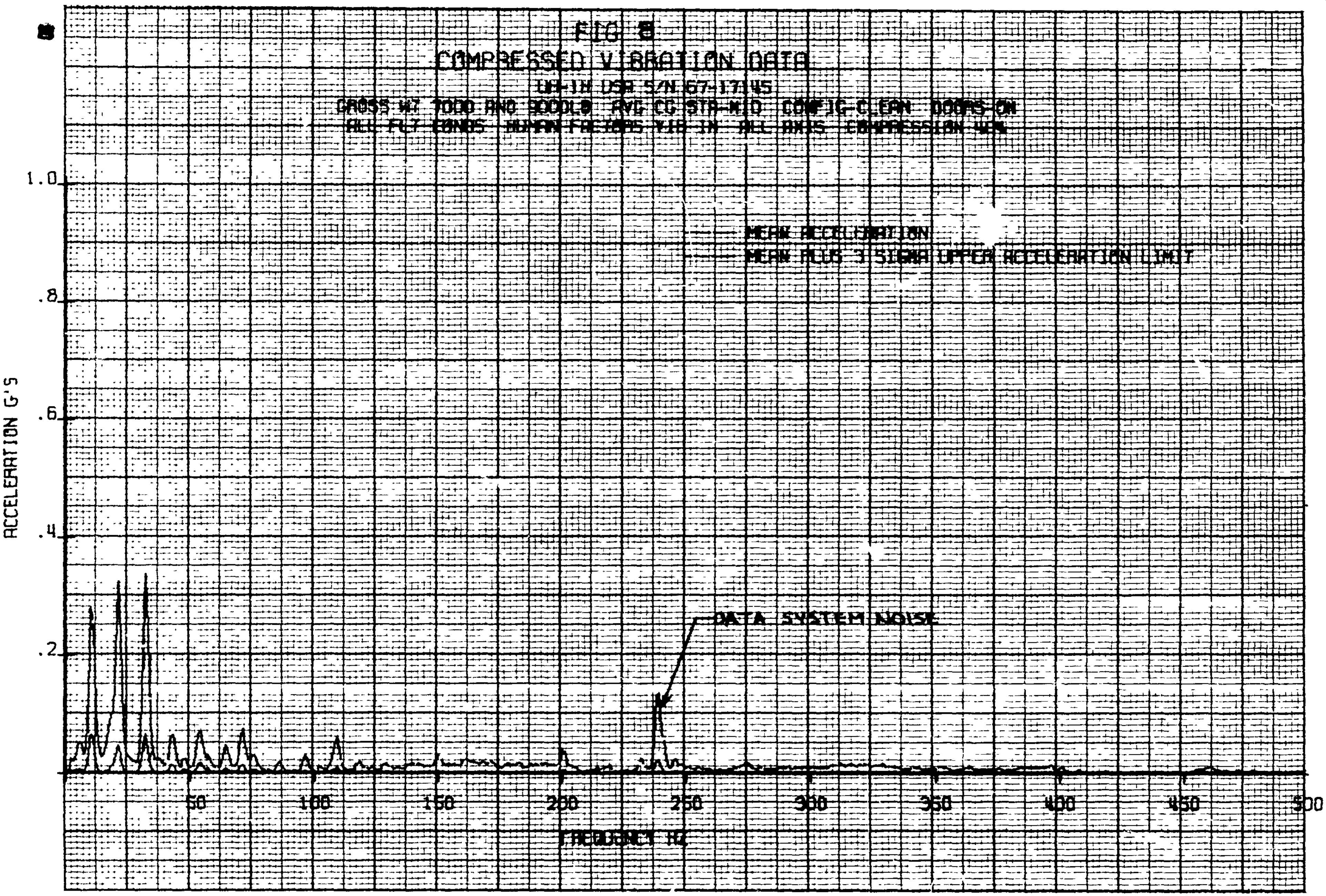


FIG 8
COMPRESSED VIBRATION DATA
UH-1H USR S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
ALL FLT CONDS HUMAN FACTORS VIB IN ALL AXIS COMPRESSION 40%
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

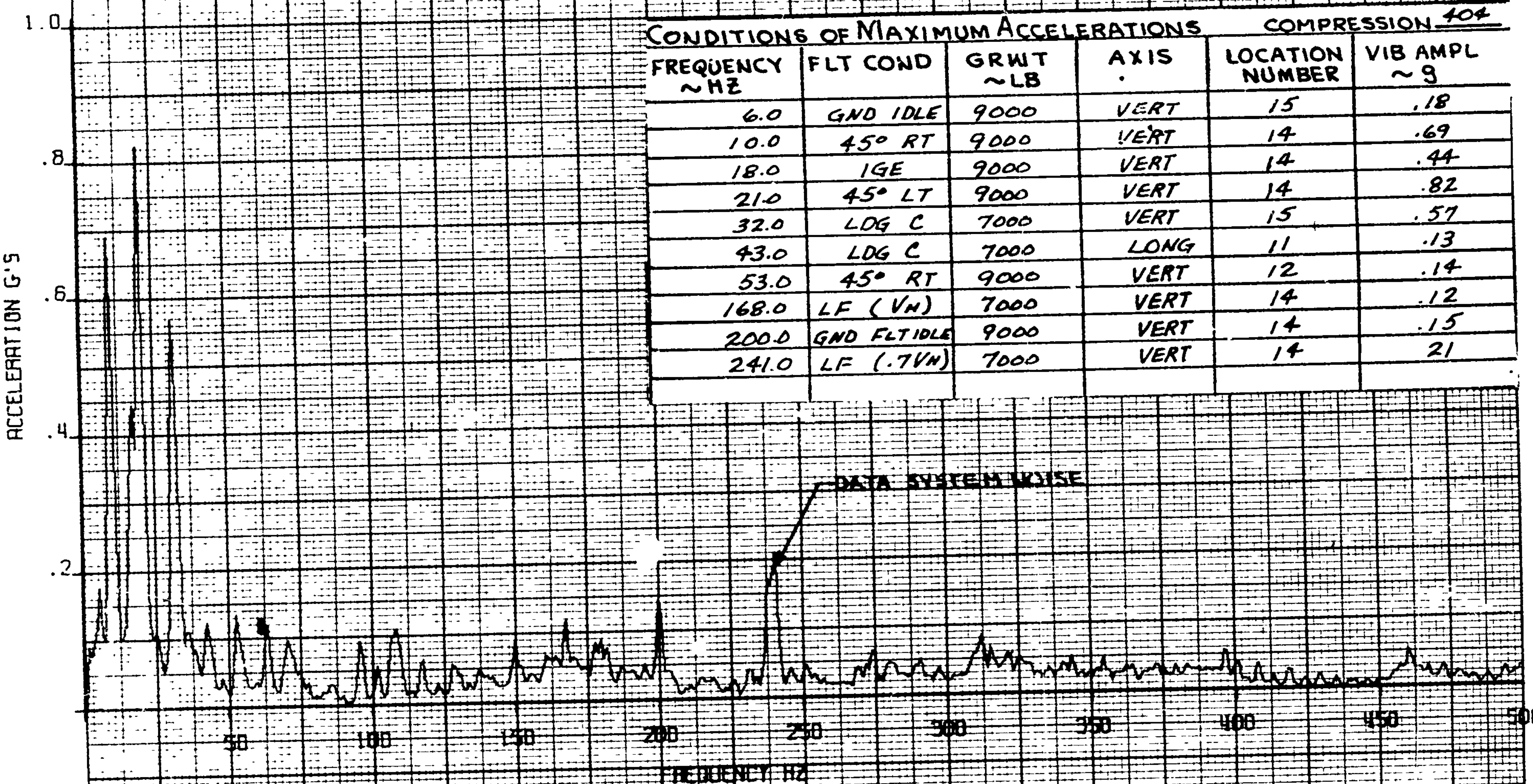
FIG 9

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

OH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000LB AVG CG 3" A-MID CONFIG-CLEAN DOORS-ON

ALL FLT CONDS HUMAN FACTORS VIB IN ALL AXIS COMPRESSION 404



CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 404

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
6.0	GND IDLE	9000	VERT	15	.18
10.0	45° RT	9000	VERT	14	.69
18.0	IGE	9000	VERT	14	.44
21.0	45° LT	9000	VERT	14	.82
32.0	LDG C	7000	VERT	15	.57
43.0	LDG C	7000	LONG	11	.13
53.0	45° RT	9000	VERT	12	.14
168.0	LF (V_H)	7000	VERT	14	.12
200.0	GND FLT IDLE	9000	VERT	14	.15
241.0	LF (.7V_H)	7000	VERT	14	21

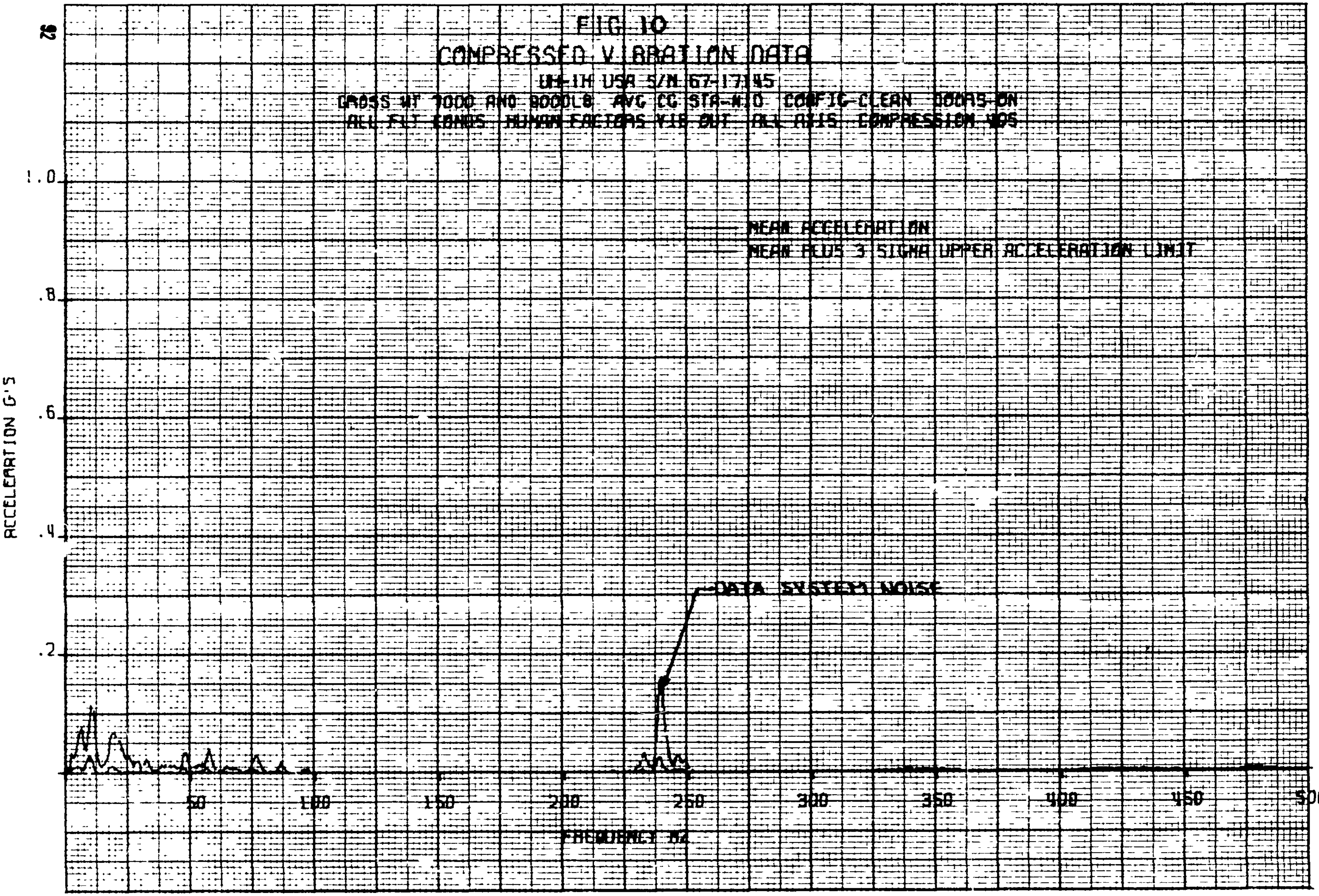


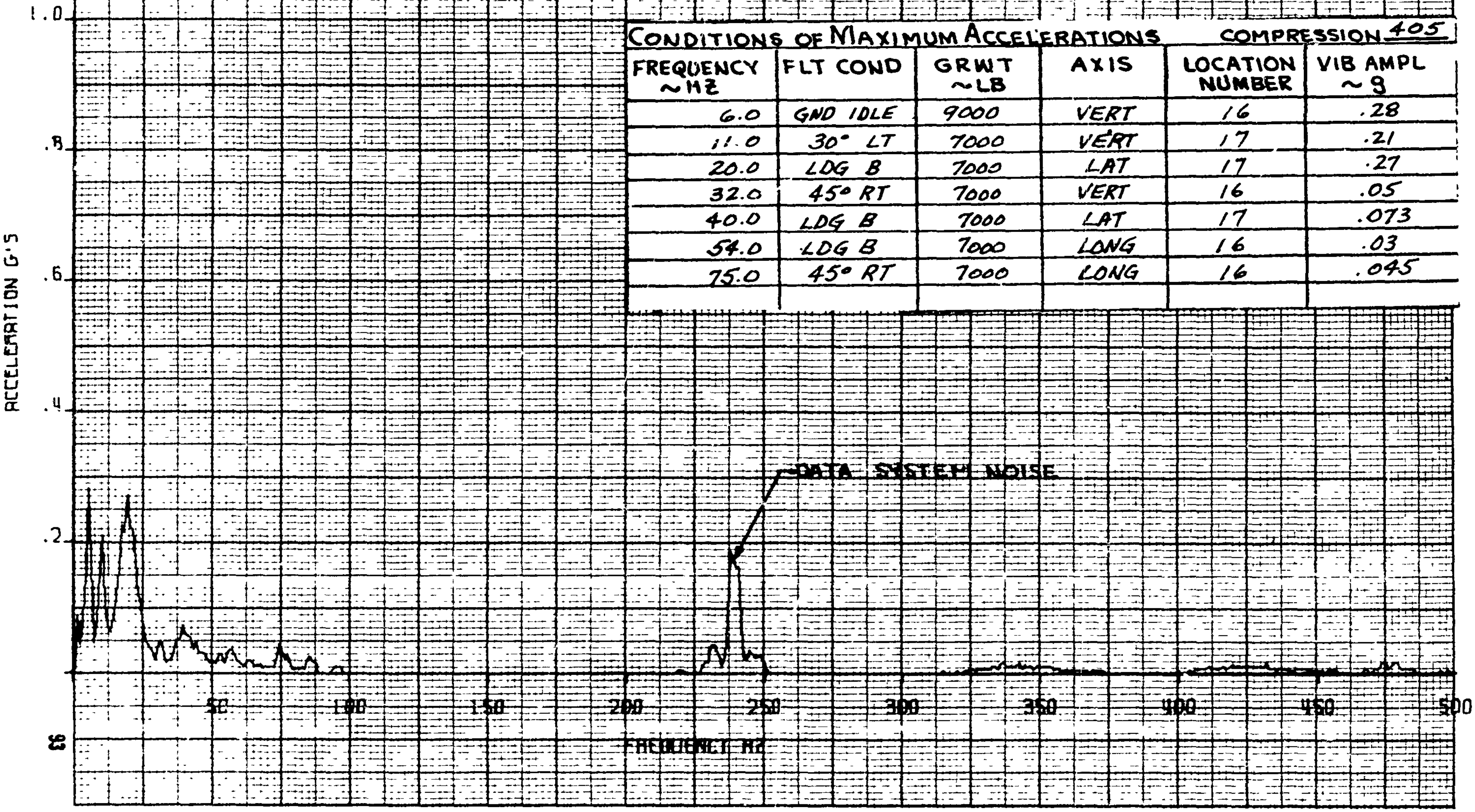
FIG 10
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 8000LB AVG CG STA-130 CONFIG-CLEAN DOORS-ON
ALL FLT CONDS HUMAN FACTORS VIB OUT ALL AXIS COMPRESSION
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

FIG 11

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
ALL FLT CONDS HUMAN FACTORS VIB OUT ALL AXIS COMPRESSION 405



CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 405

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
6.0	GND IDLE	9000	VERT	16	.28
11.0	30° LT	7000	VERT	17	.21
20.0	LDG B	7000	LAT	17	.27
32.0	45° RT	7000	VERT	16	.05
40.0	LDG B	7000	LAT	17	.073
54.0	LDG B	7000	LONG	16	.03
75.0	45° RT	7000	LONG	16	.045

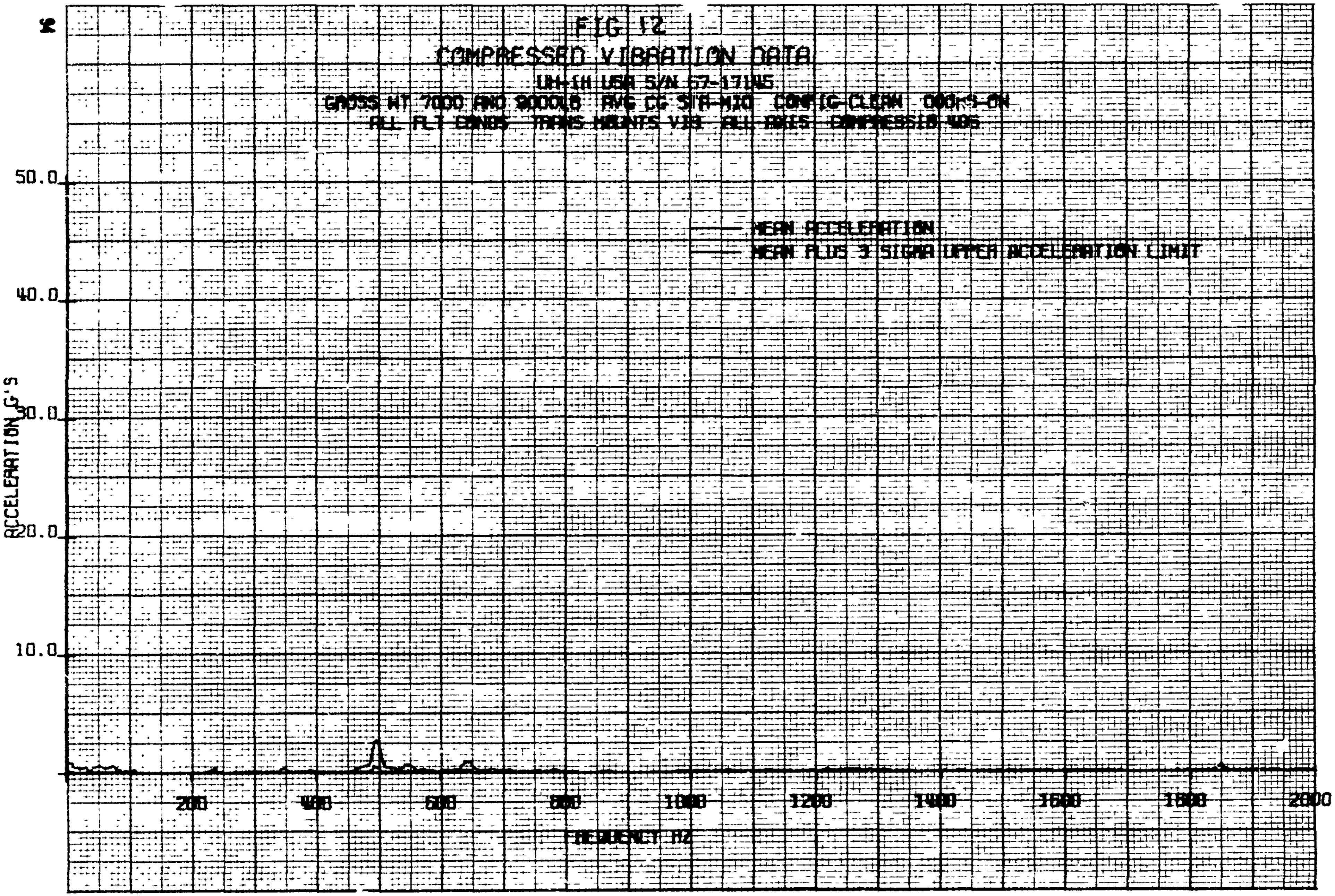


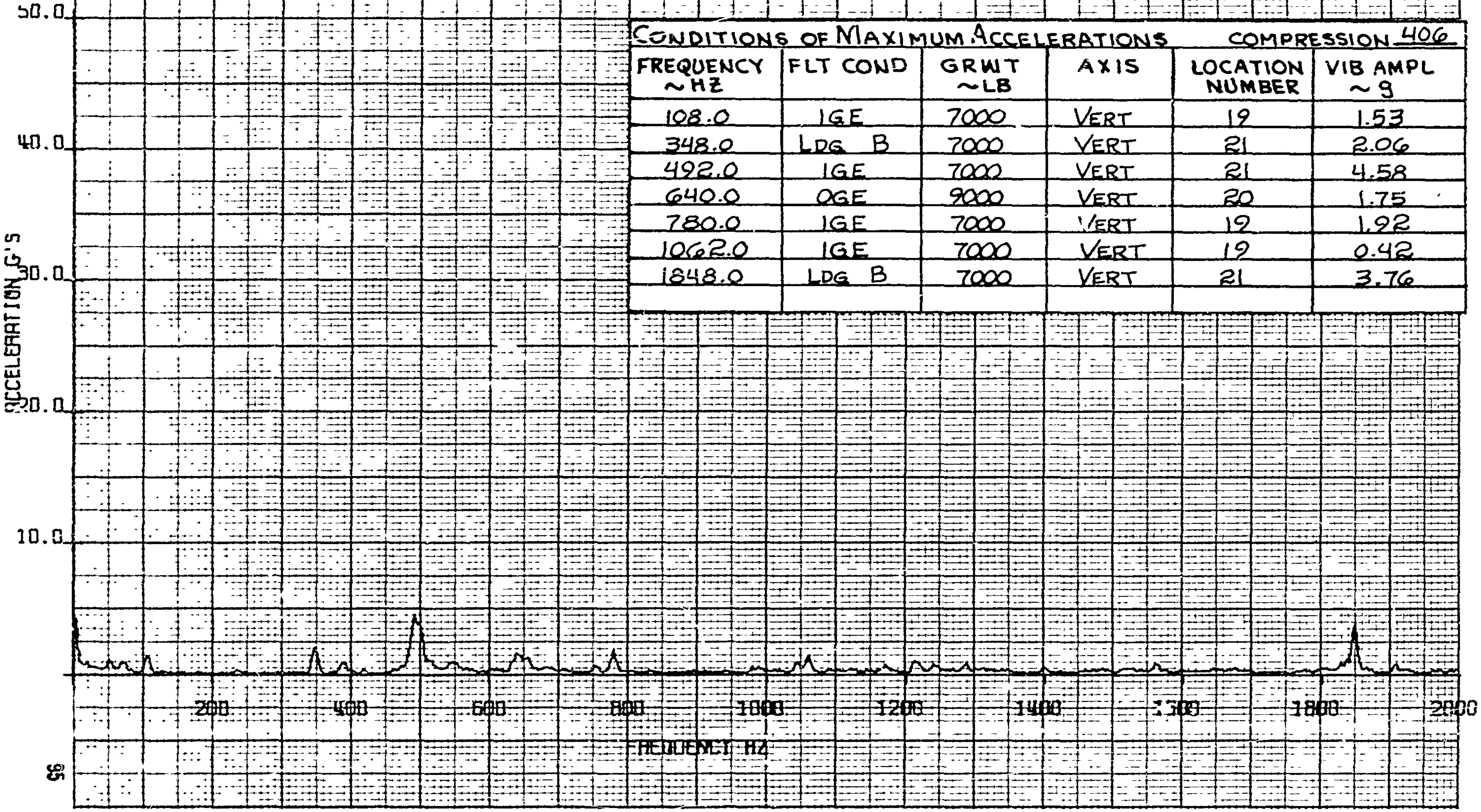
FIG 12
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
ALL FLT CONDS TRANS MOUNTS V13 ALL AXIS COMPRESSIB 406
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
50.0
40.0
30.0
20.0
10.0
ACCELERATION G'S
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

FIG 13

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H US7 S/N 67-17145

GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
ALL FLT CONDS TRANS MOUNTS VIB ALL AXIS COMPRESSION 406



CONDITIONS OF MAXIMUM ACCELERATIONS				COMPRESSION 406	
FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
108.0	IGE	7000	VERT	19	1.53
348.0	LDG B	7000	VERT	21	2.06
492.0	IGE	7000	VERT	21	4.58
640.0	OGE	9000	VERT	20	1.75
780.0	IGE	7000	VERT	19	1.92
1062.0	IGE	7000	VERT	19	0.42
1848.0	LDG B	7000	VERT	21	3.76

FIG 14

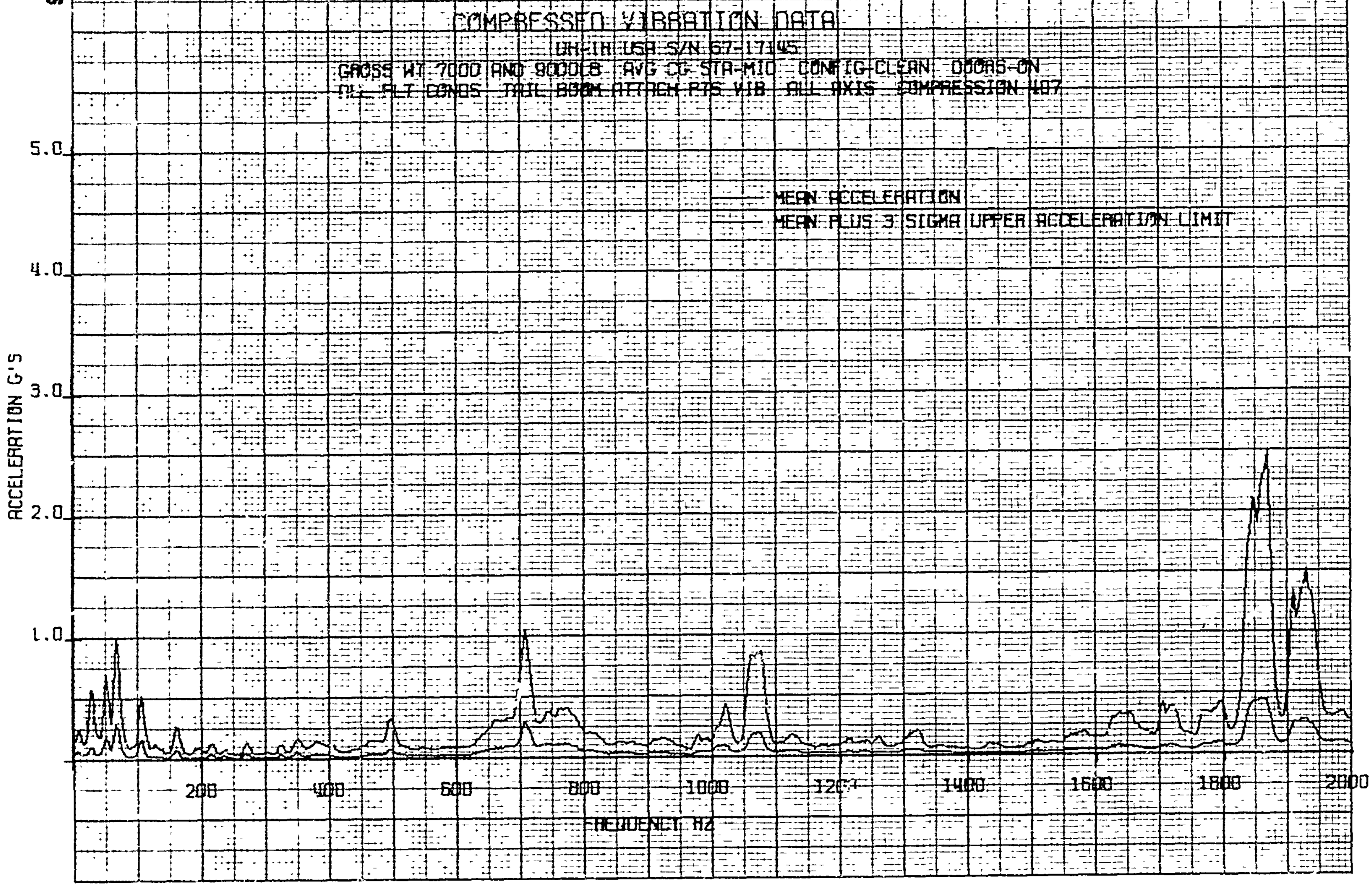
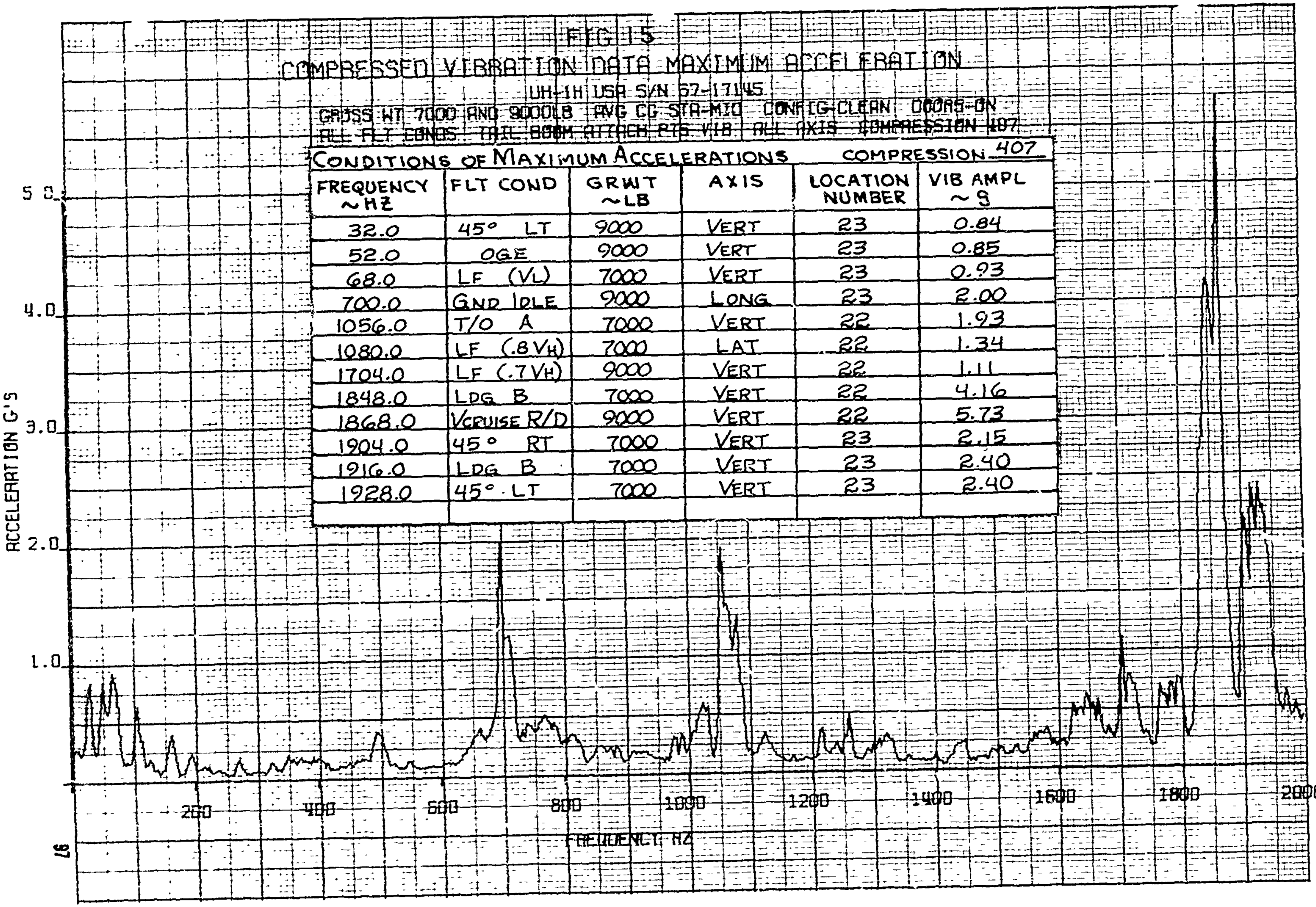

COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
ALL FLT CONDS TAIL BOOM ATTACH P75 VIB ALL AXIS COMPRESSION 407
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
5.0
4.0
3.0
2.0
1.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

FIG 15

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

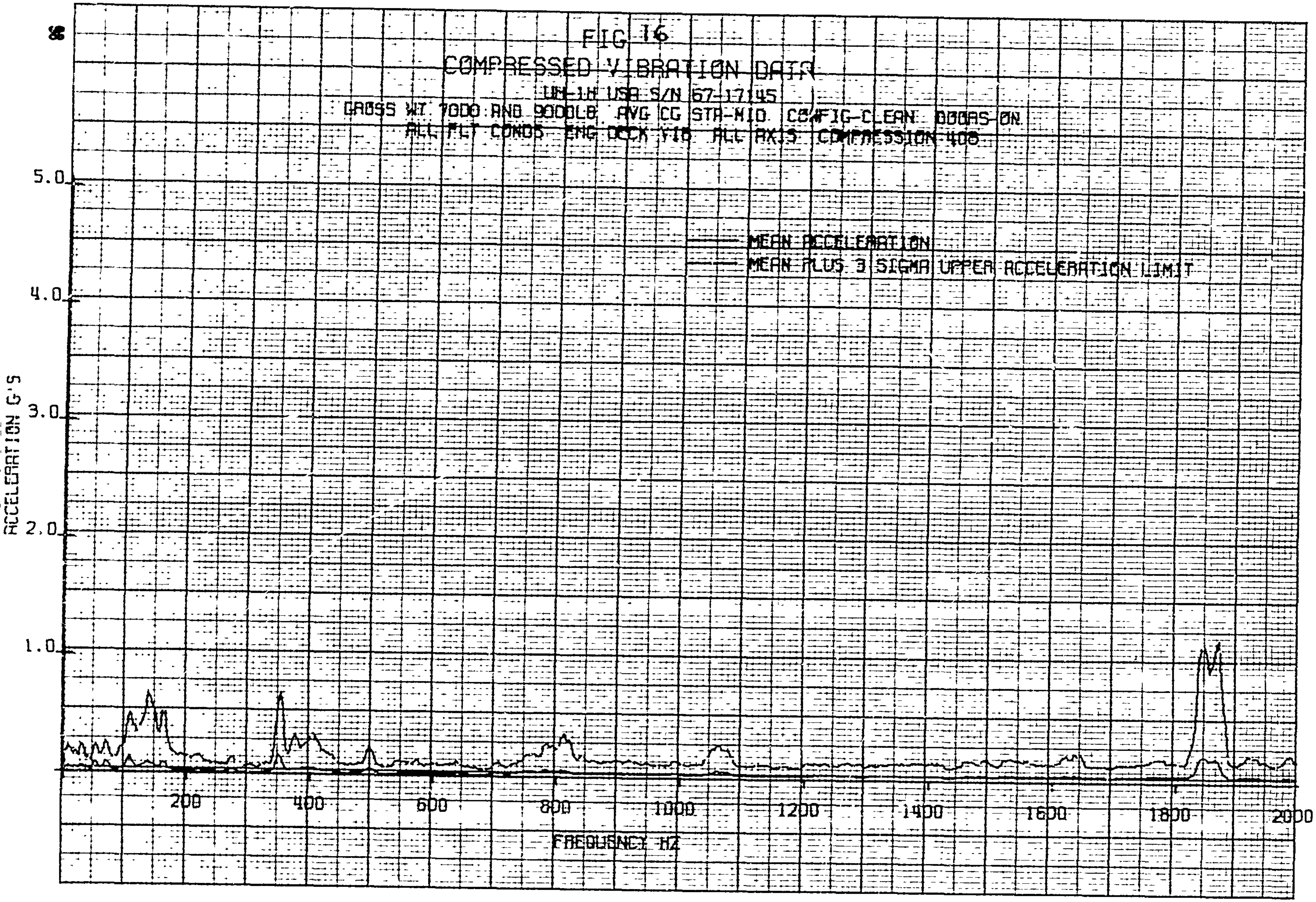
UH-1H USA S/N 67-17145

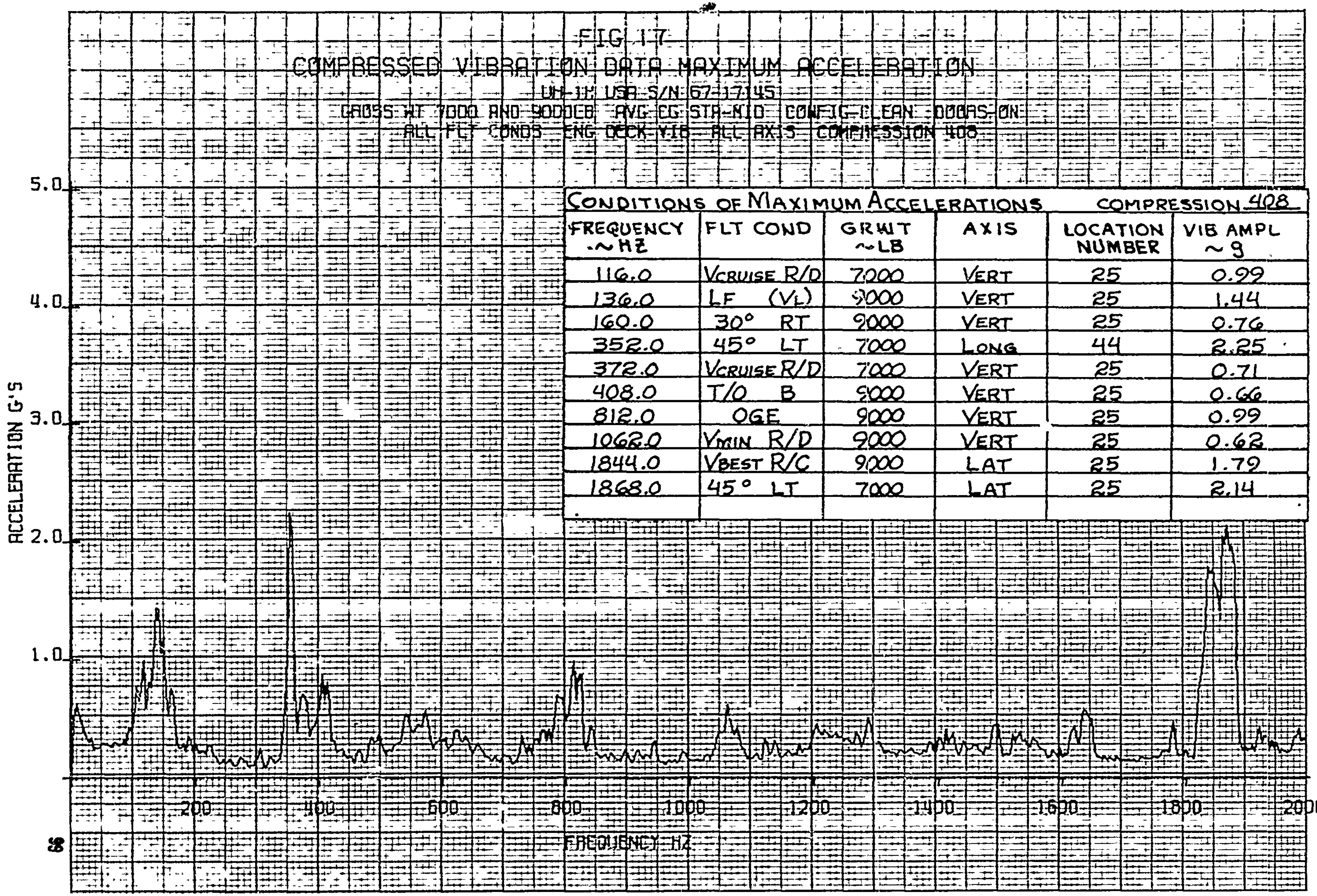
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
ALL FLT CONDS TAIL BOOM ATTACH R76 VIB ALL AXIS COMPRESSION 407



CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 407

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
32.0	45° LT	9000	VERT	23	0.84
52.0	OGE	9000	VERT	23	0.85
68.0	LF (VL)	7000	VERT	23	0.93
700.0	GND IDLE	9000	LONG	23	2.00
1056.0	T/O A	7000	VERT	22	1.93
1080.0	LF (.8 VH)	7000	LAT	22	1.34
1704.0	LF (.7 VH)	9000	VERT	22	1.11
1848.0	LDG B	7000	VERT	22	4.16
1868.0	VCRUISE R/D	9000	VERT	22	5.73
1904.0	45° RT	7000	VERT	23	2.15
1916.0	LDG B	7000	VERT	23	2.40
1928.0	45° LT	7000	VERT	23	2.40


98
FIG 16
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS ON
ALL FLT CONDS ENG DECK VIB ALL AXIS COMPRESSION 400
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
5.0
4.0
3.0
2.0
1.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ



CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 408

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
116.0	V_{CRUISE} R/D	7000	VERT	25	0.99
136.0	LF (V_L)	9000	VERT	25	1.44
160.0	30° RT	9000	VERT	25	0.76
352.0	45° LT	7000	LONG	44	2.25
372.0	V_{CRUISE} R/D	7000	VERT	25	0.71
408.0	T/O B	9000	VERT	25	0.66
812.0	OGE	9000	VERT	25	0.99
1062.0	V_{MIN} R/D	9000	VERT	25	0.62
1844.0	V_{BEST} R/C	9000	LAT	25	1.79
1868.0	45° LT	7000	LAT	25	2.14

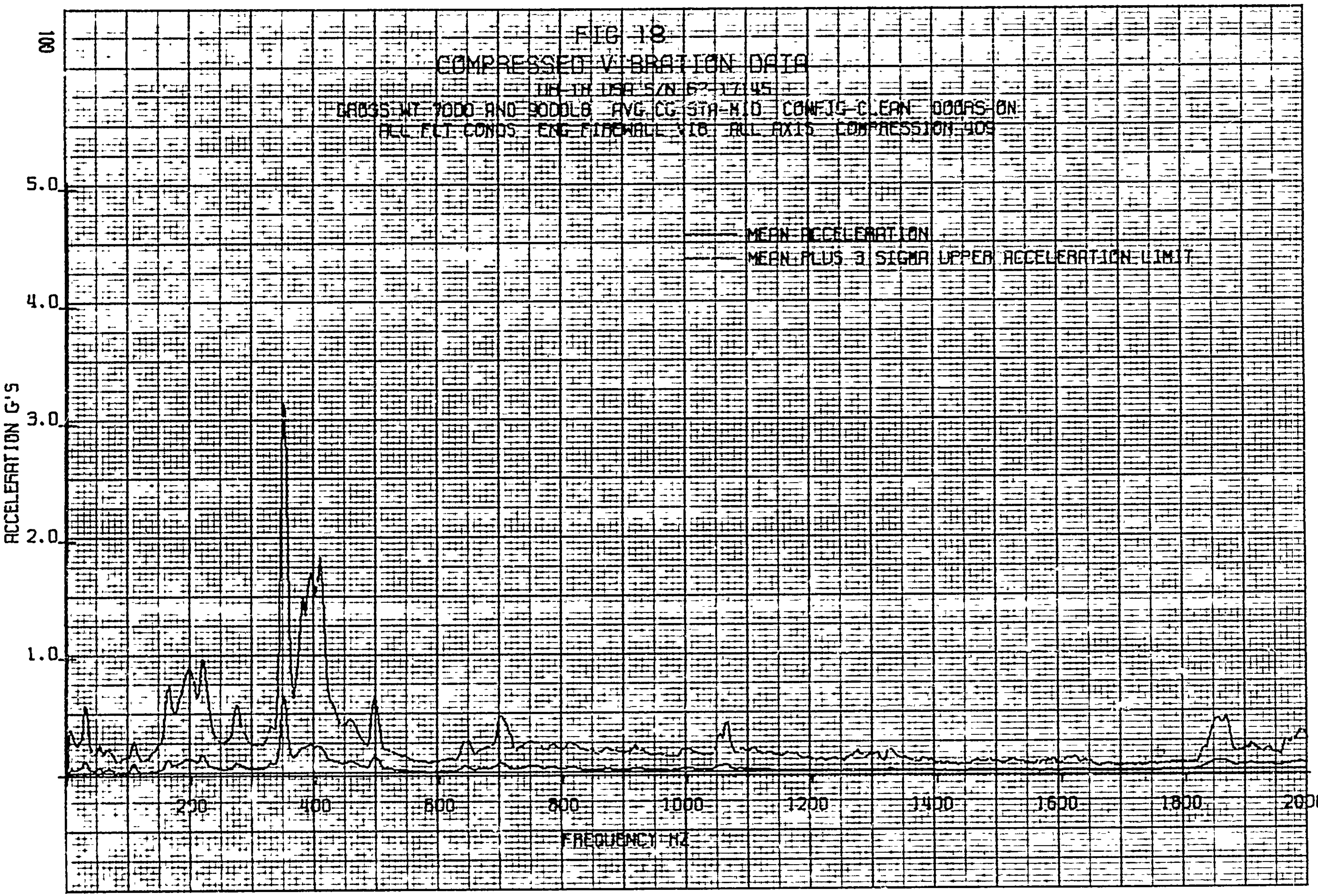
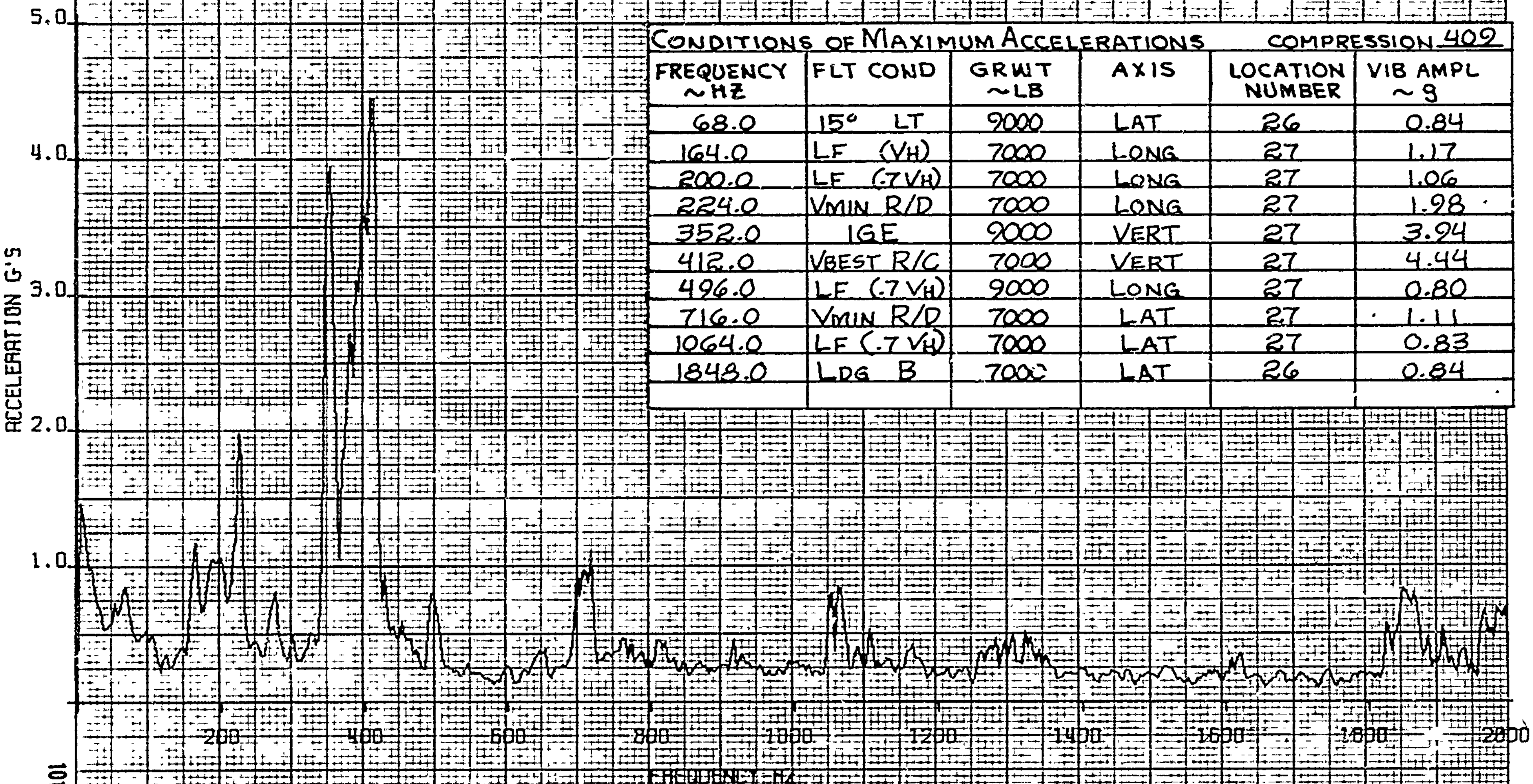


FIG 18
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS ON
ALL FLT CONDS ENG FIREWALL V18 ALL AXIS COMPRESSION 40S
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
1.0
2.0
3.0
4.0
5.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

FIG. 19
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
ALL FLT CONDS ENG FIREWALL VIB ALL AXIS COMPRESSION 409



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 409

FREQUENCY ~HZ	FLT COND	GR WT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
68.0	15° LT	9000	LAT	26	0.84
164.0	LF (VH)	7000	LONG	27	1.17
200.0	LF (.7VH)	7000	LONG	27	1.06
224.0	VMIN R/D	7000	LONG	27	1.98
352.0	IGE	9000	VERT	27	3.94
412.0	VBEST R/C	7000	VERT	27	4.44
496.0	LF (.7 VH)	9000	LONG	27	0.80
716.0	VMIN R/D	7000	LAT	27	1.11
1064.0	LF (.7 VH)	7000	LAT	27	0.83
1848.0	LDG B	7000	LAT	26	0.84

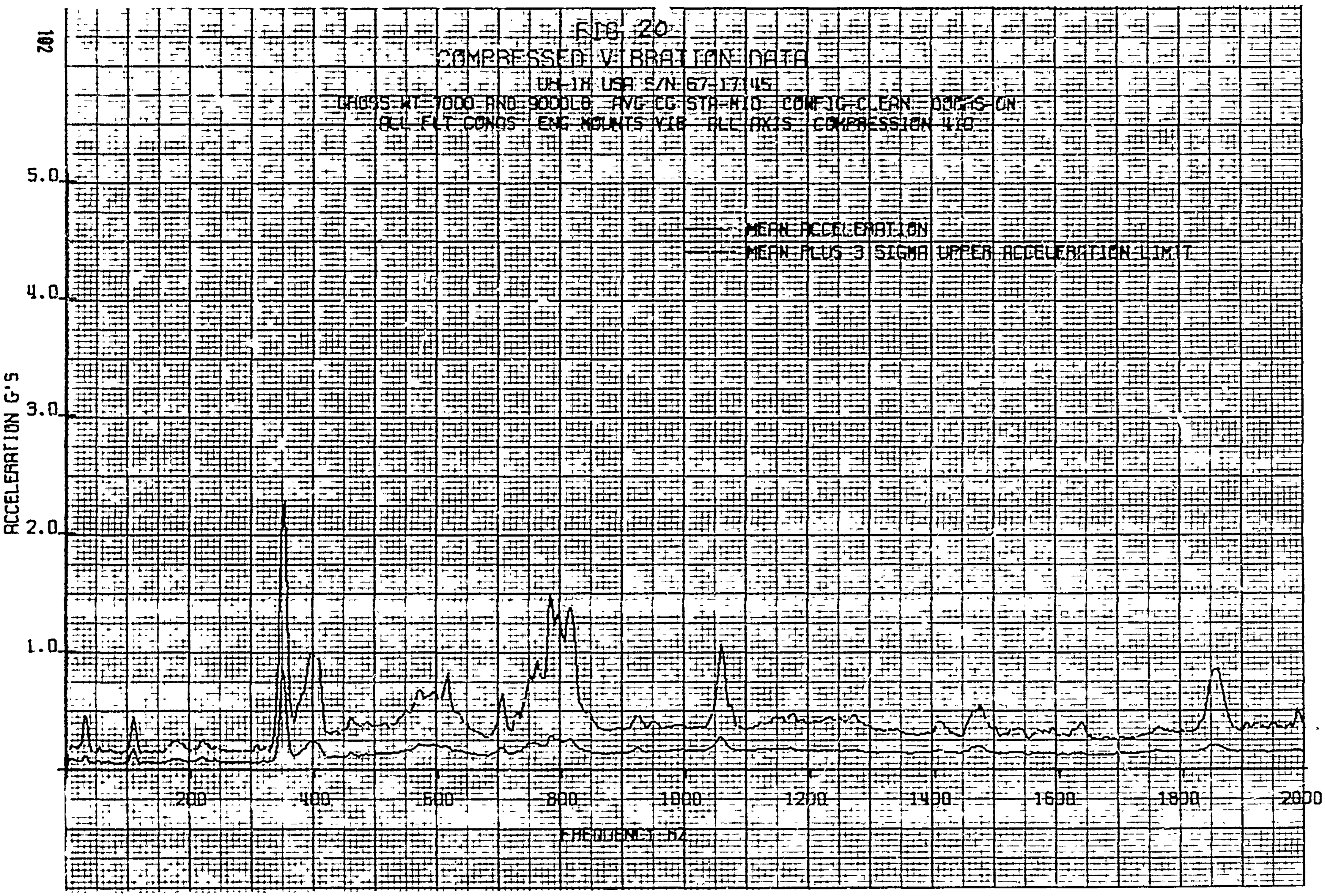


FIG 20
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN
ALL FLT CONDS ENG MOUNTS VIB ALL AXIS COMPRESSION
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
5.0
4.0
3.0
2.0
1.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

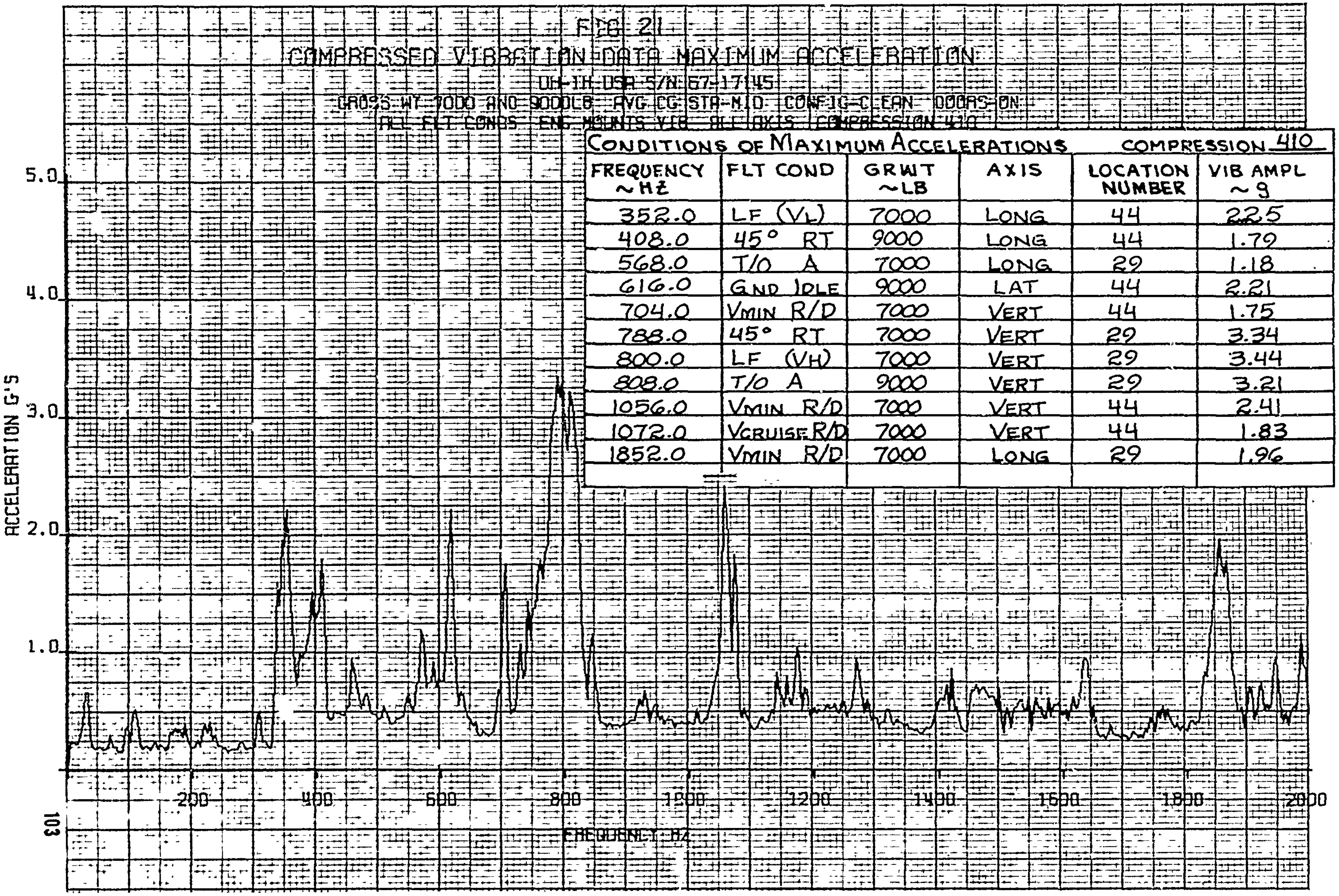
FIG 21

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON

ALL FLT CONDS ENG MOUNTS VIB ALL AXIS COMPRESSION 410



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 410

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
352.0	LF (V_L)	7000	LONG	44	2.25
408.0	45° RT	9000	LONG	44	1.79
568.0	T/O A	7000	LONG	29	1.18
616.0	GND IDLE	9000	LAT	44	2.21
704.0	V_{MIN} R/D	7000	VERT	44	1.75
788.0	45° RT	7000	VERT	29	3.34
800.0	LF (V_H)	7000	VERT	29	3.44
808.0	T/O A	9000	VERT	29	3.21
1056.0	V_{MIN} R/D	7000	VERT	44	2.41
1072.0	V_{CRUISE} R/D	7000	VERT	44	1.83
1852.0	V_{MIN} R/D	7000	LONG	29	1.96

FIG 22
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
ALL FLT CONDS TAIL ROTOR SERVO VIB ALL AXIS COMPRESSION 4:1

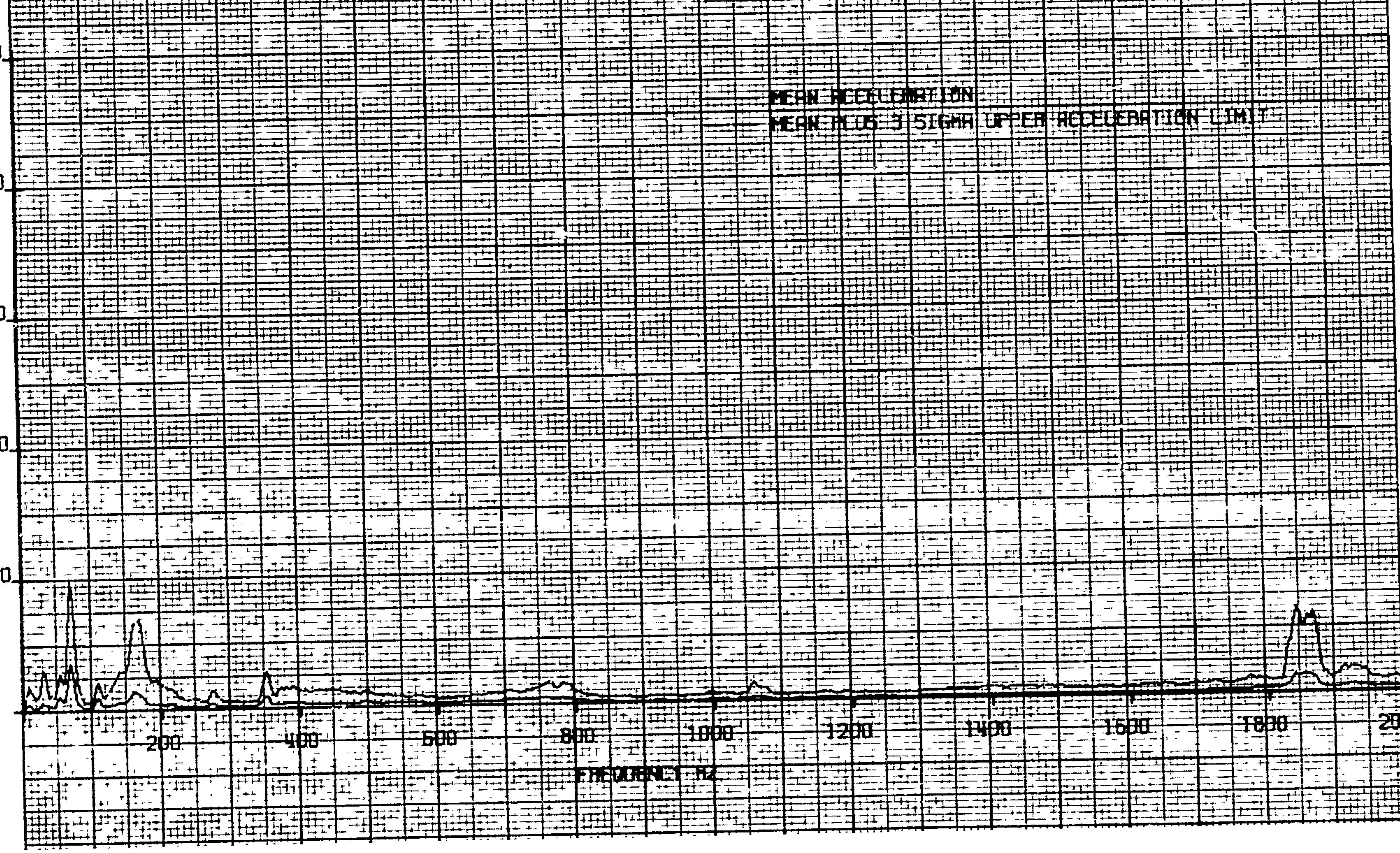


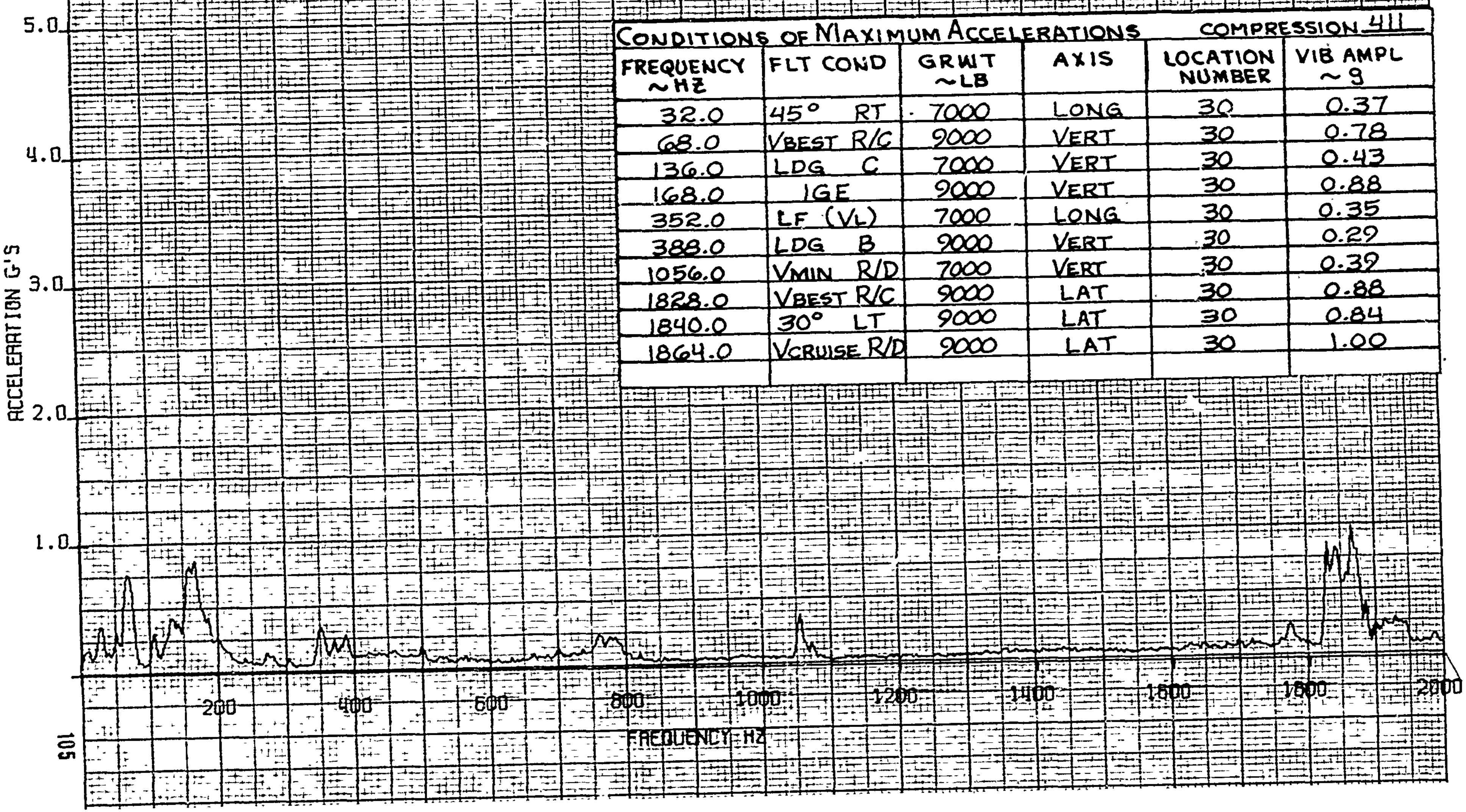
FIG 23

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON

ALL FLT CONDS TAIL ROTOR SERVO V12 ALL AXIS COMPRESSION 411



CONDITIONS OF MAXIMUM ACCELERATIONS				COMPRESSION 411	
FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
32.0	45° RT	7000	LONG	30	0.37
68.0	V_{BEST} R/C	9000	VERT	30	0.78
136.0	LDG C	7000	VERT	30	0.43
168.0	IGE	9000	VERT	30	0.88
352.0	LF (V_L)	7000	LONG	30	0.35
388.0	LDG B	9000	VERT	30	0.29
1056.0	V_{MIN} R/D	7000	VERT	30	0.39
1828.0	V_{BEST} R/C	9000	LAT	30	0.88
1840.0	30° LT	9000	LAT	30	0.84
1864.0	V_{CRUISE} R/D	9000	LAT	30	1.00

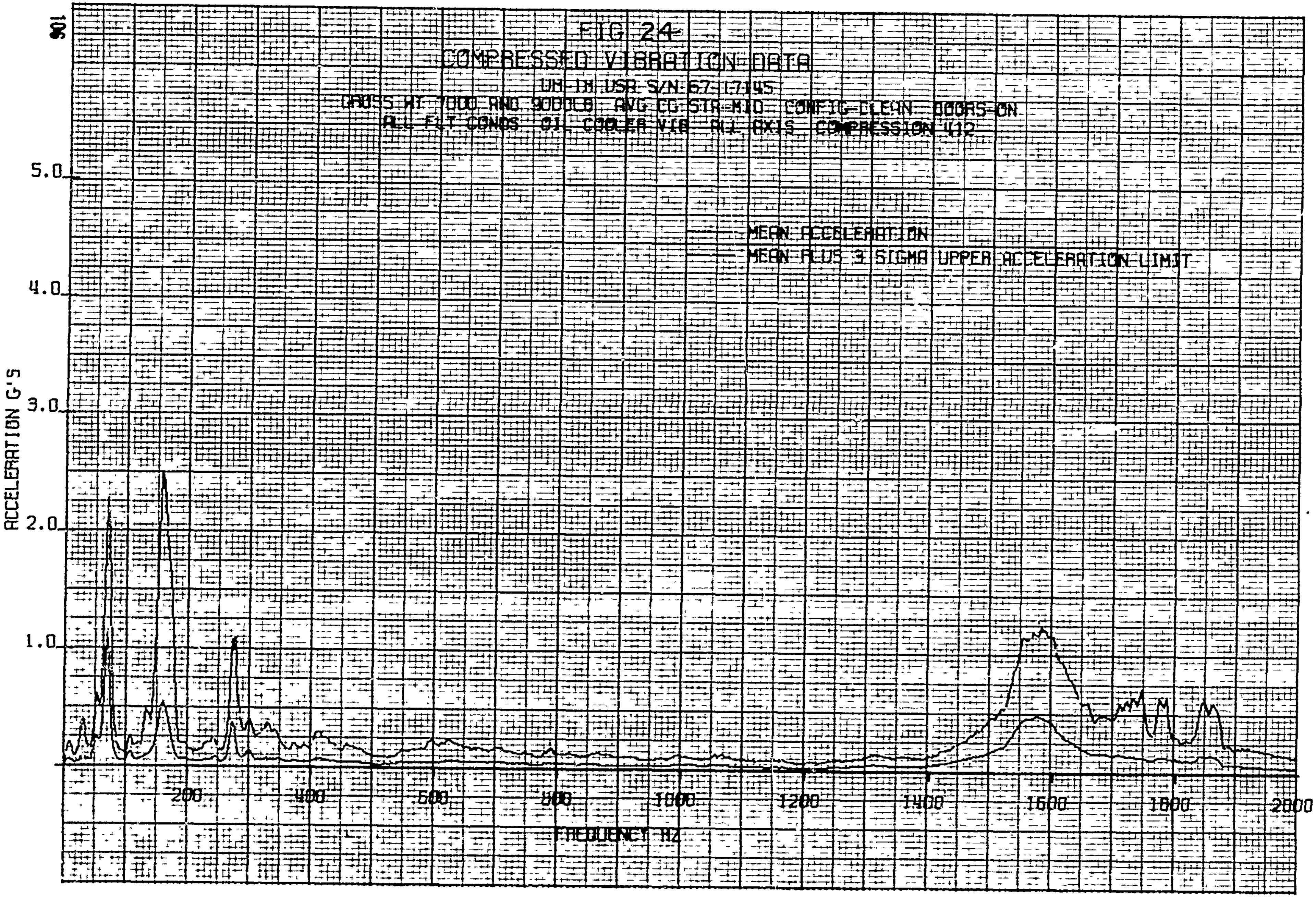


FIG 24
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA MID CONFIG-CLEAN DOORS-ON
ALL FLT CONDS OIL COOLER VIB ALL AXIS COMPRESSION 412
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
5.0
4.0
3.0
2.0
1.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

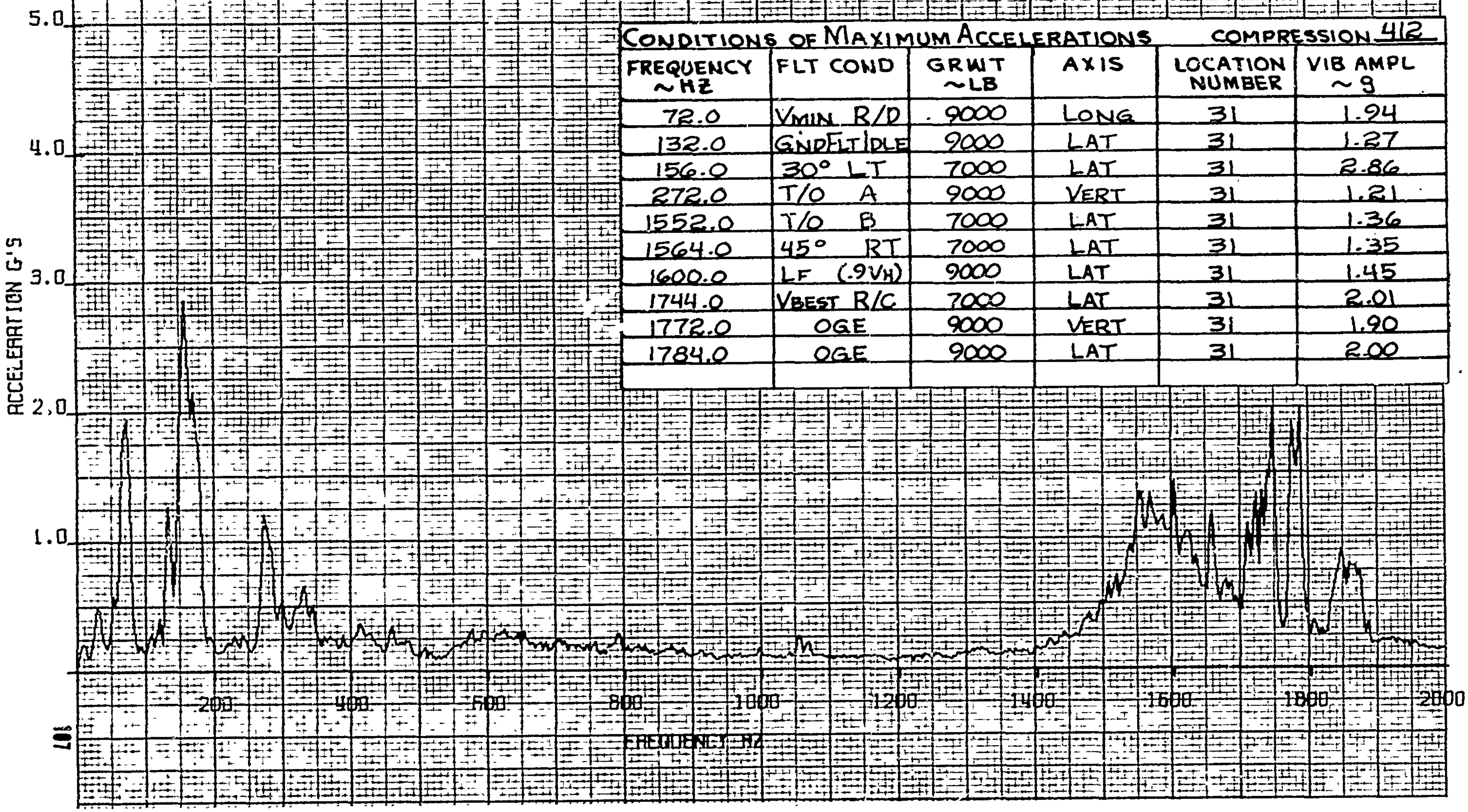
FIG 25

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000LB AVG CG STA MID CONFIG CLEAN DOORS ON

ALL FLT CONDS 31 COOLER VIB ALL AXIS COMPRESSION 412



CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 412

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
72.0	VMIN R/D	9000	LONG	31	1.94
132.0	GND FLT IDLE	9000	LAT	31	1.27
156.0	30° LT	7000	LAT	31	2.86
272.0	T/O A	9000	VERT	31	1.21
1552.0	T/O B	7000	LAT	31	1.36
1564.0	45° RT	7000	LAT	31	1.35
1600.0	LF (.9VH)	9000	LAT	31	1.45
1744.0	VBEST R/C	7000	LAT	31	2.01
1772.0	OGE	9000	VERT	31	1.90
1784.0	OGE	9000	LAT	31	2.00

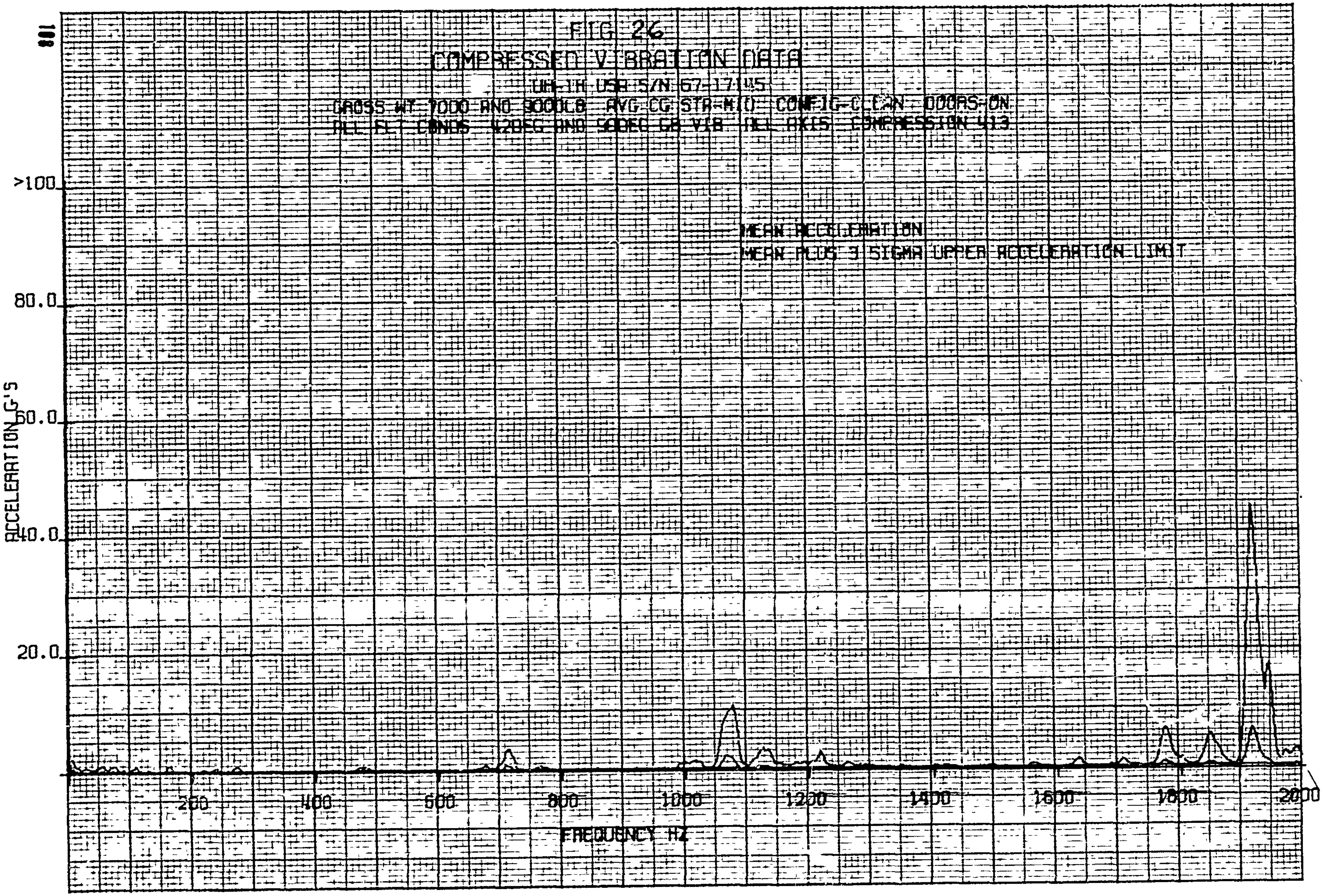


FIG 26
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
ALL FLT CONDS 42DEG AND 90DEG GB VIB ALL AXIS COMPRESSION 413
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
>100
80.0
60.0
40.0
20.0
ACCELERATION G'S
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

FIG 27

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

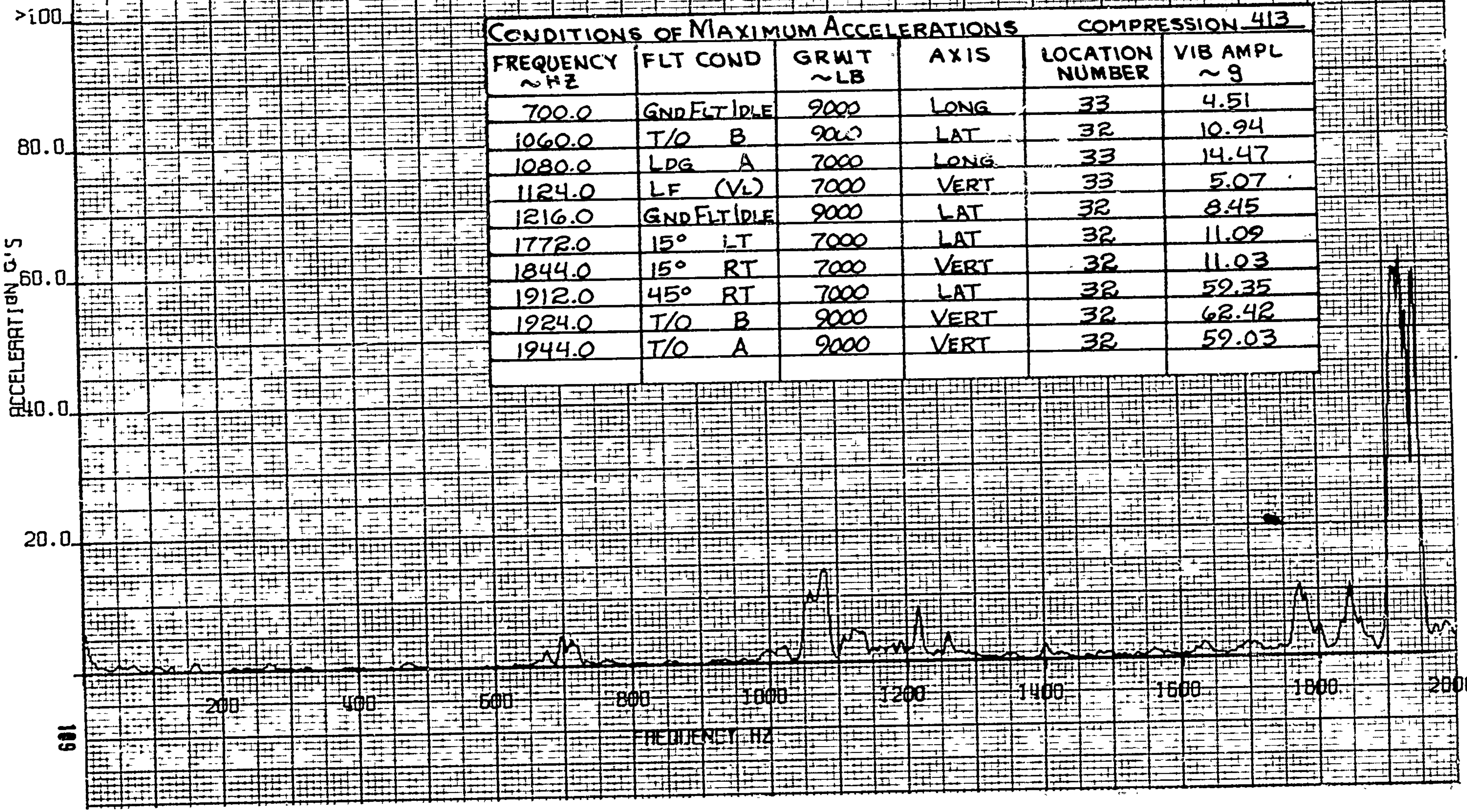
UH-1N USA S/N 67-17145

GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON

ALL FLT CONDS 420EG AND 900EG CB VIB ALL AXIS COMPRESSION 413

CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 413

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
700.0	GND FLT IDLE	9000	LONG	33	4.51
1060.0	T/O B	9000	LAT	32	10.94
1080.0	LDG A	7000	LONG	33	14.47
1124.0	LF (VL)	7000	VERT	33	5.07
1216.0	GND FLT IDLE	9000	LAT	32	8.45
1772.0	15° LT	7000	LAT	32	11.09
1844.0	15° RT	7000	VERT	32	11.03
1912.0	45° RT	7000	LAT	32	59.35
1924.0	T/O B	9000	VERT	32	62.42
1944.0	T/O A	9000	VERT	32	59.03



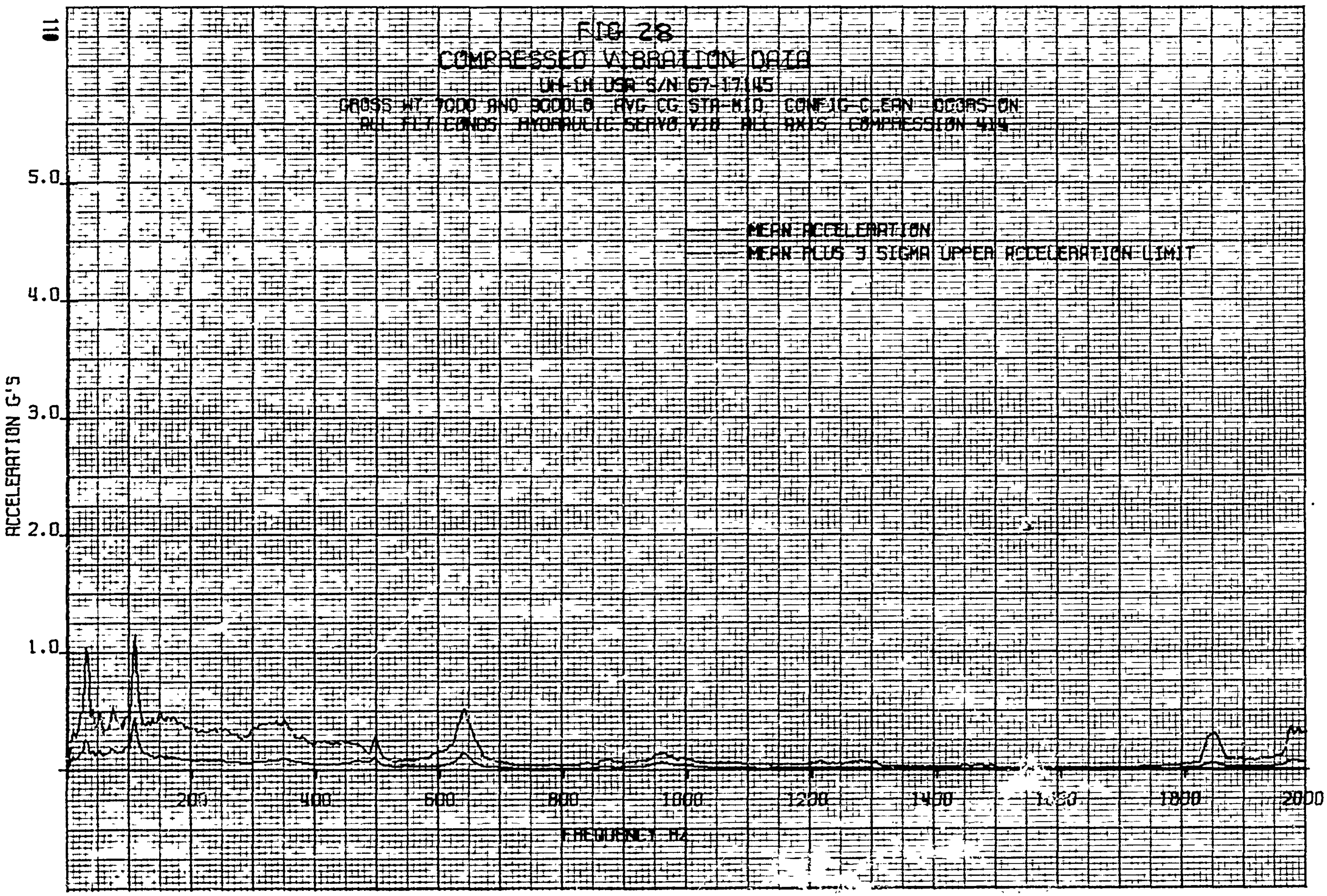


FIG 28
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG CLEAN DOORS ON
ALL FLT CONDS HYDRAULIC SERVO VIB ALL AXIS COMPRESSION 4:1
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
5.0
4.0
3.0
2.0
1.0
200
400
600
800
1000
1200
1400
1800
2000
FREQUENCY HZ

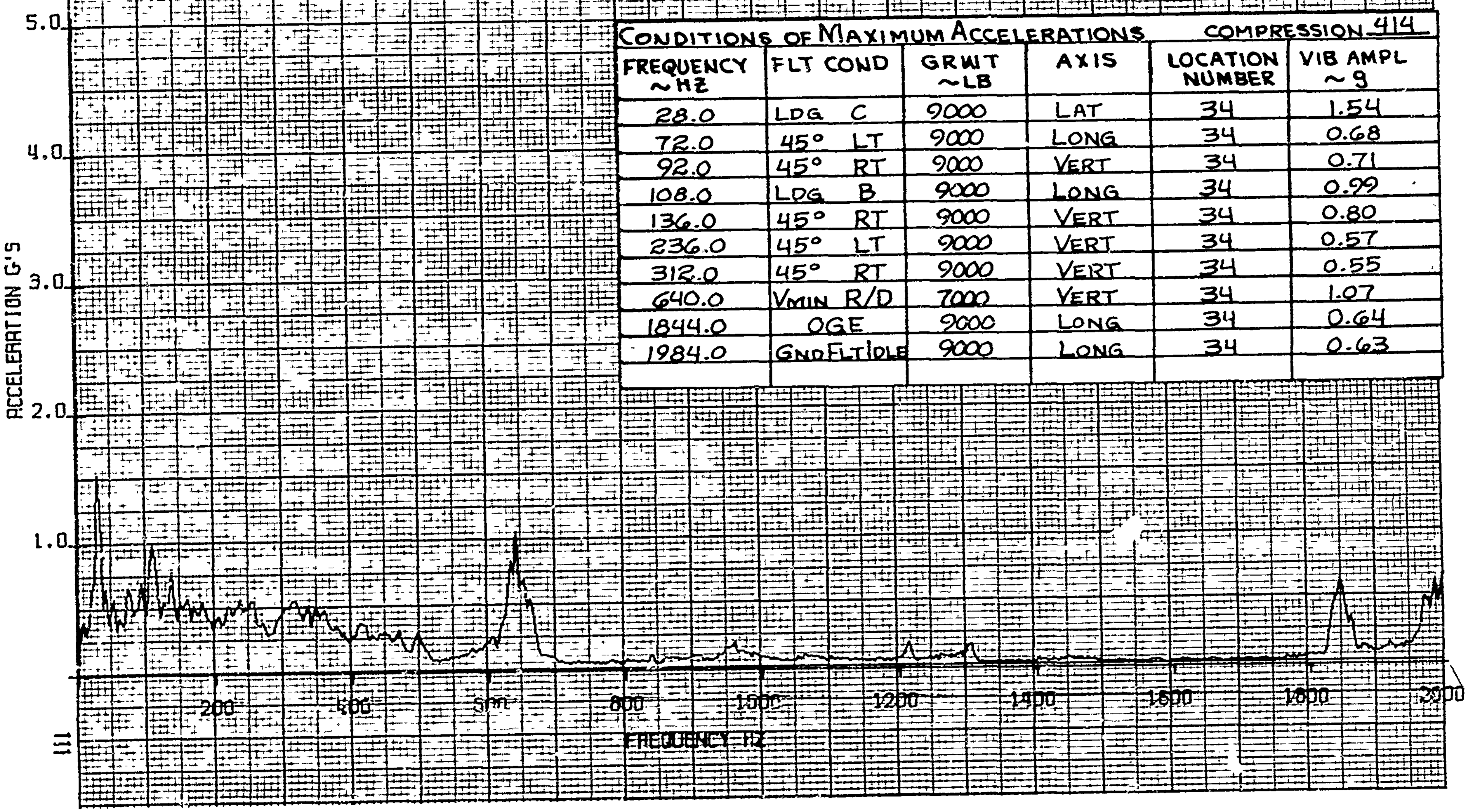
FIG 29

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON

ALL FLT CONDS HYDRAULIC SERVO VIB ALL AXIS COMPRESSION 414



CONDITIONS OF MAXIMUM ACCELERATIONS				COMPRESSION 414	
FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
28.0	LDG C	9000	LAT	34	1.54
72.0	45° LT	9000	LONG	34	0.68
92.0	45° RT	9000	VERT	34	0.71
108.0	LDG B	9000	LONG	34	0.99
136.0	45° RT	9000	VERT	34	0.80
236.0	45° LT	9000	VERT	34	0.57
312.0	45° RT	9000	VERT	34	0.55
640.0	V_{MIN} R/D	7000	VERT	34	1.07
1844.0	OGE	9000	LONG	34	0.64
1984.0	GND FLT IDLE	9000	LONG	34	0.63

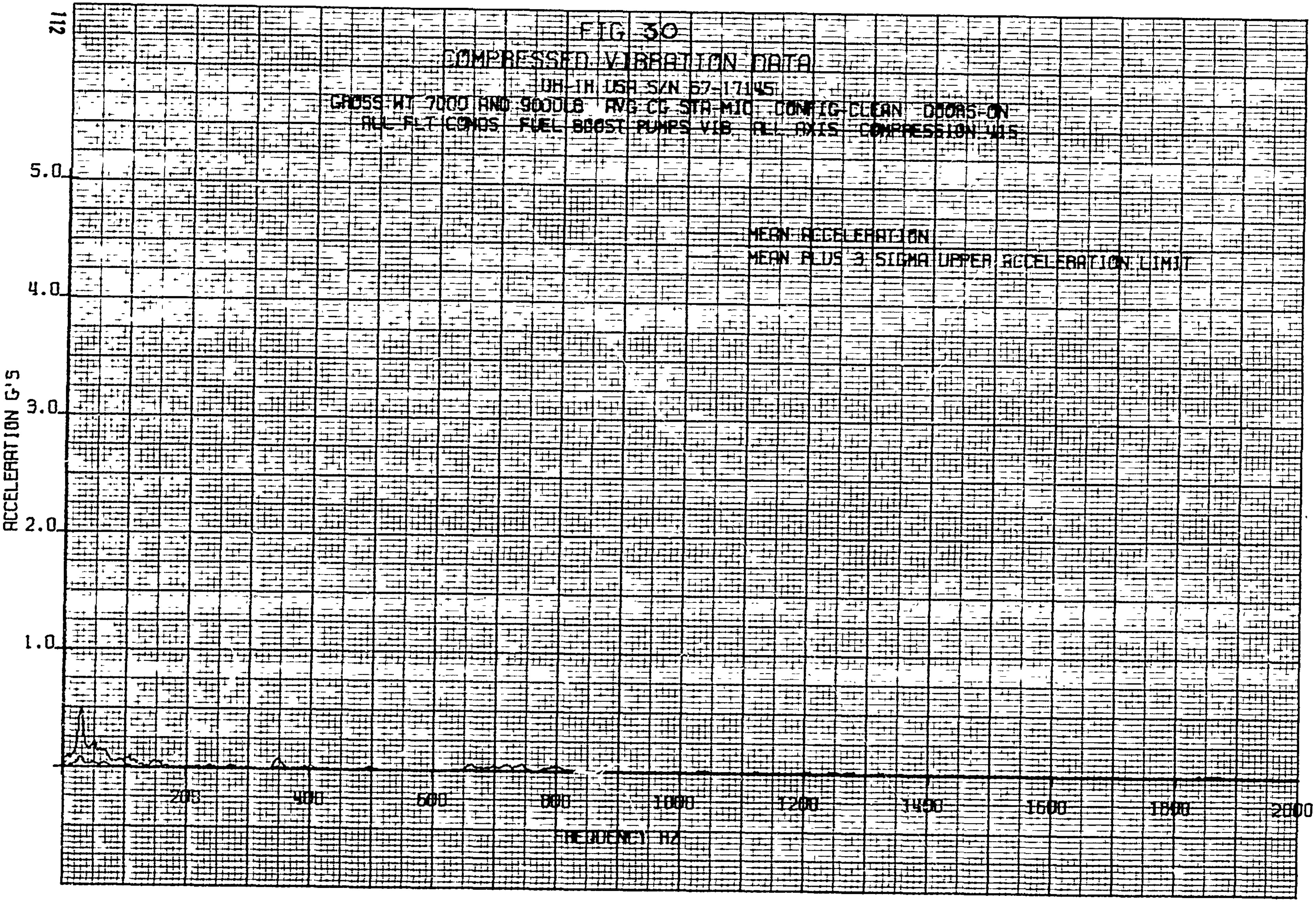


FIG 30
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
ALL FLT CONDS FUEL BOOST PUMPS VIB ALL AXIS COMPRESSION 115

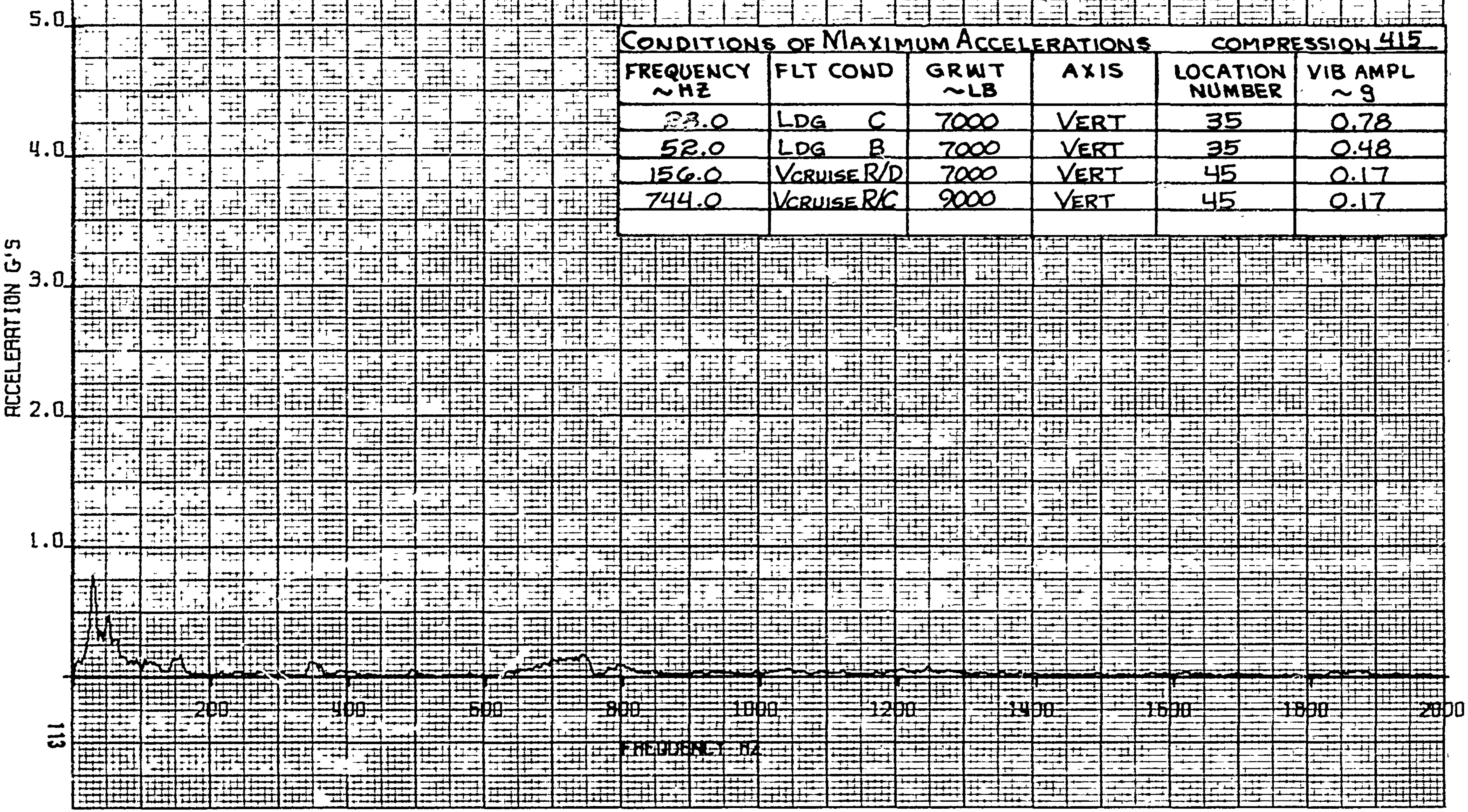
FIG 31

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000 LB AVG CG STA MID CONFIG CLEAN DOORS ON

ALL FLT CONDS FUEL BOOST PUMPS VIB ALL AXIS COMPRESSION 415



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 415

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
23.0	LDG C	7000	VERT	35	0.78
52.0	LDG B	7000	VERT	35	0.48
156.0	VCRUISE R/D	7000	VERT	45	0.17
744.0	VCRUISE R/C	9000	VERT	45	0.17

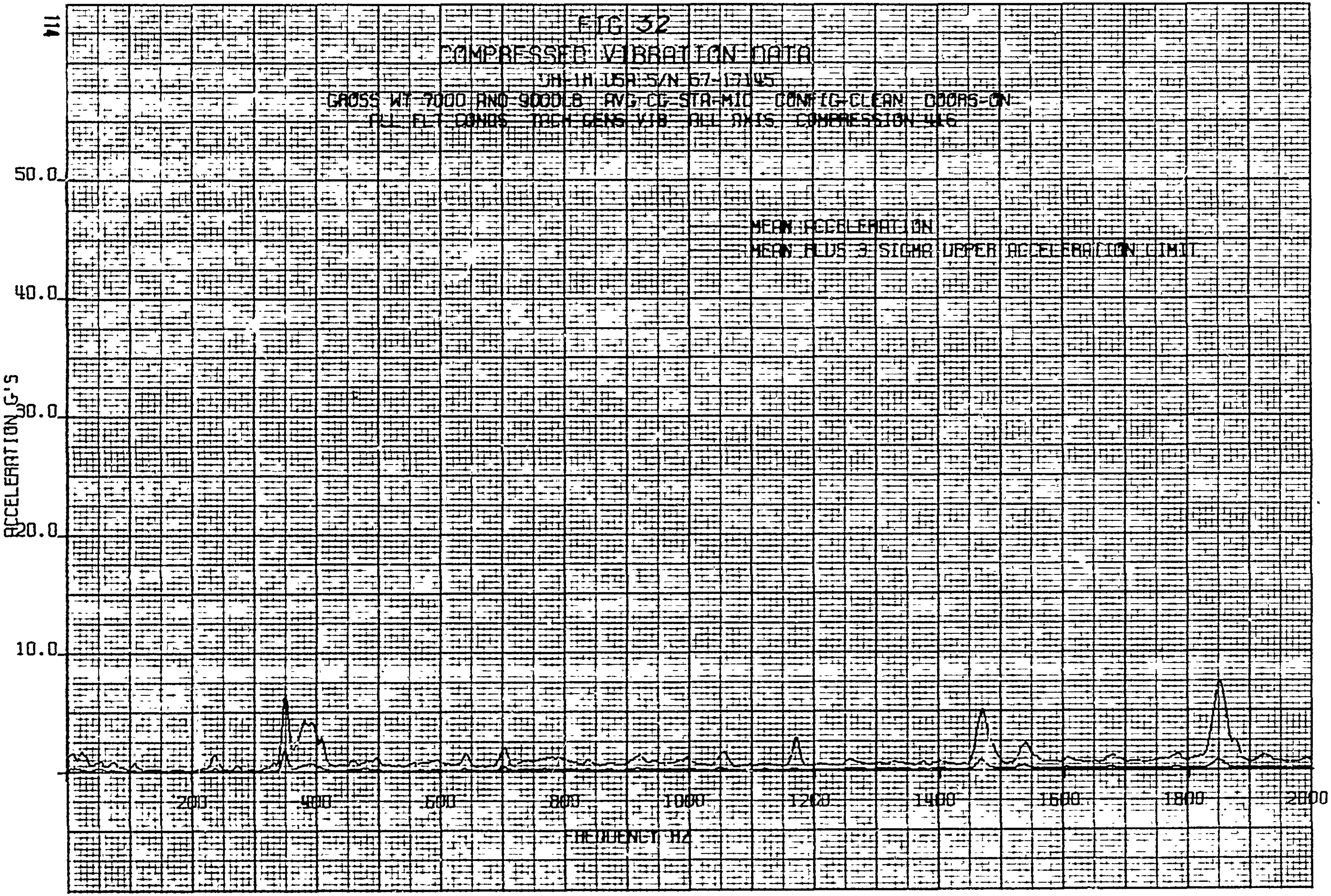


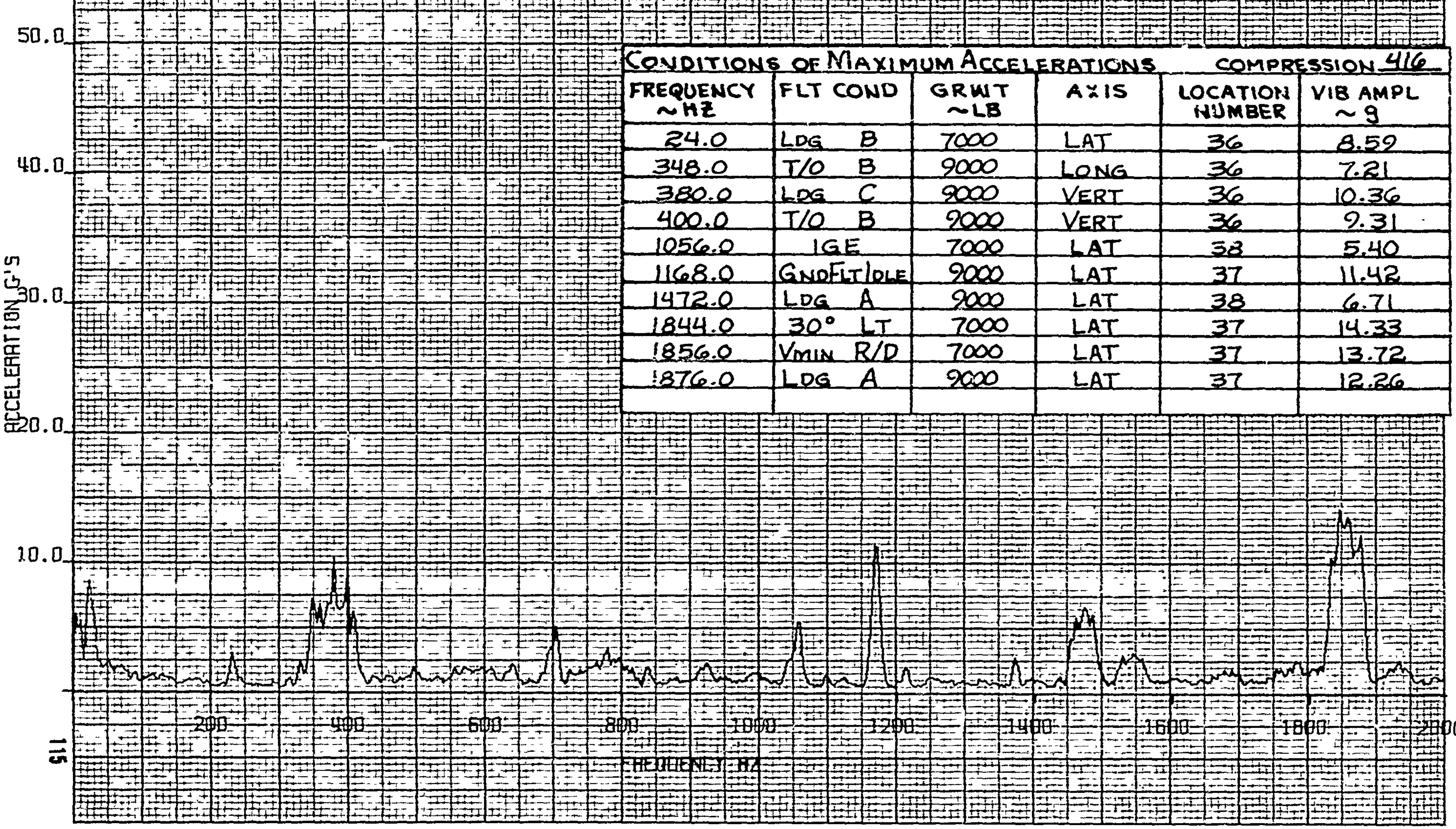
FIG 32
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG-STA-MID CONFIG-CLEAN DOORS-ON
ALL FLT CONDS TACH GENS VIB ALL AXIS COMPRESSION
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
50.0
40.0
30.0
20.0
10.0
ACCELERATION G'S
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

FIG 33

COMPRESSED VIBRATION DATA-MAXIMUM ACCELERATION

UH-1H USA S/N 57-17145

GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS ON
ALL FLT CONDS TECH SENS VIB ALL AXIS COMPRESSION 416



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 416

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
24.0	LDG B	7000	LAT	36	8.59
348.0	T/O B	9000	LONG	36	7.21
380.0	LDG C	9000	VERT	36	10.36
400.0	T/O B	9000	VERT	36	9.31
1056.0	IGE	7000	LAT	38	5.40
1168.0	GNDFLT/IDLE	9000	LAT	37	11.42
1472.0	LDG A	9000	LAT	38	6.71
1844.0	30° LT	7000	LAT	37	14.33
1856.0	VMIN R/D	7000	LAT	37	13.72
1876.0	LDG A	9000	LAT	37	12.26

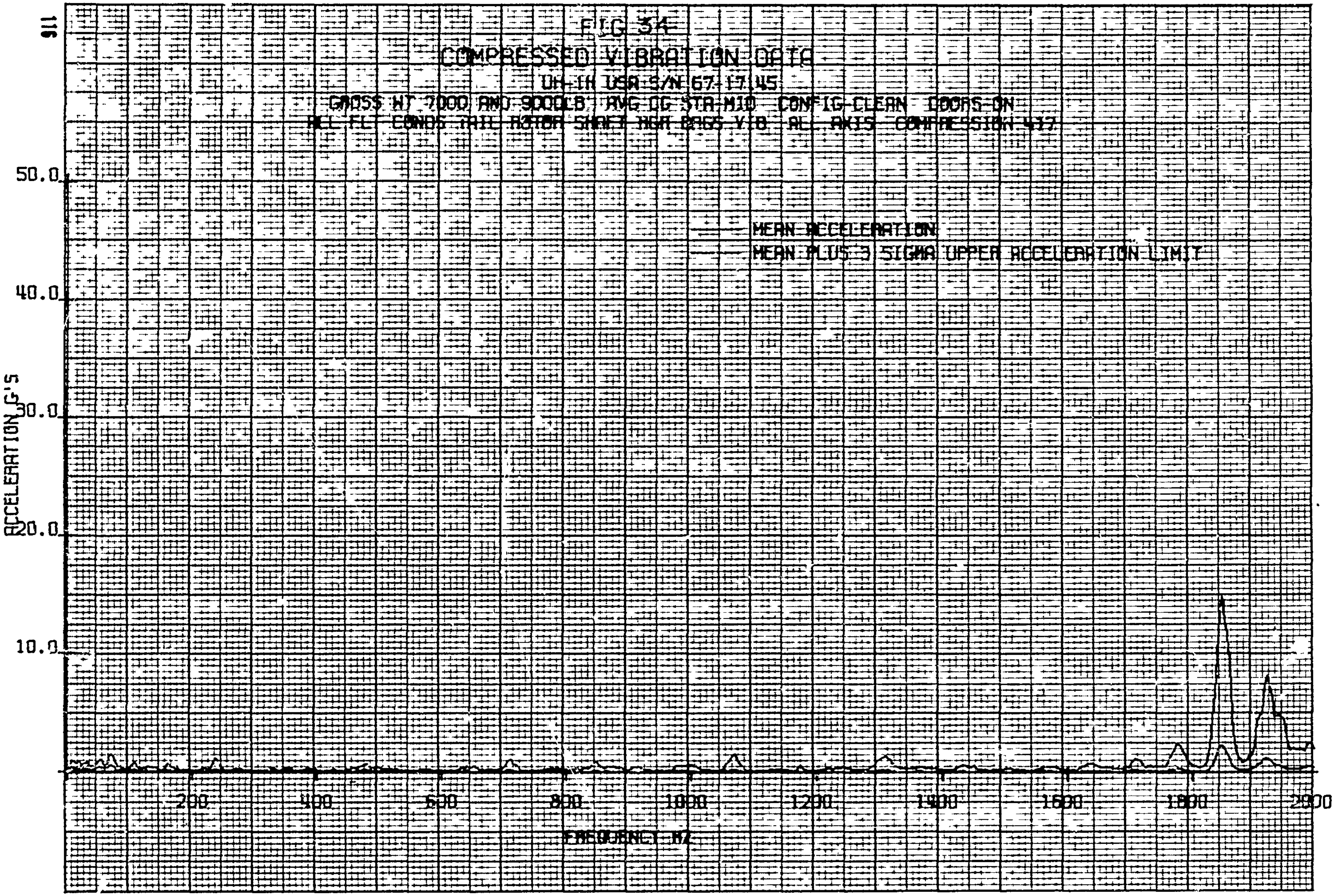


FIG 34
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
ALL FL CONDS TAIL ROTOR SHAFT HGR BRGS VIB ALL AXIS COMPRESSION 417
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
50.0
40.0
30.0
20.0
10.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

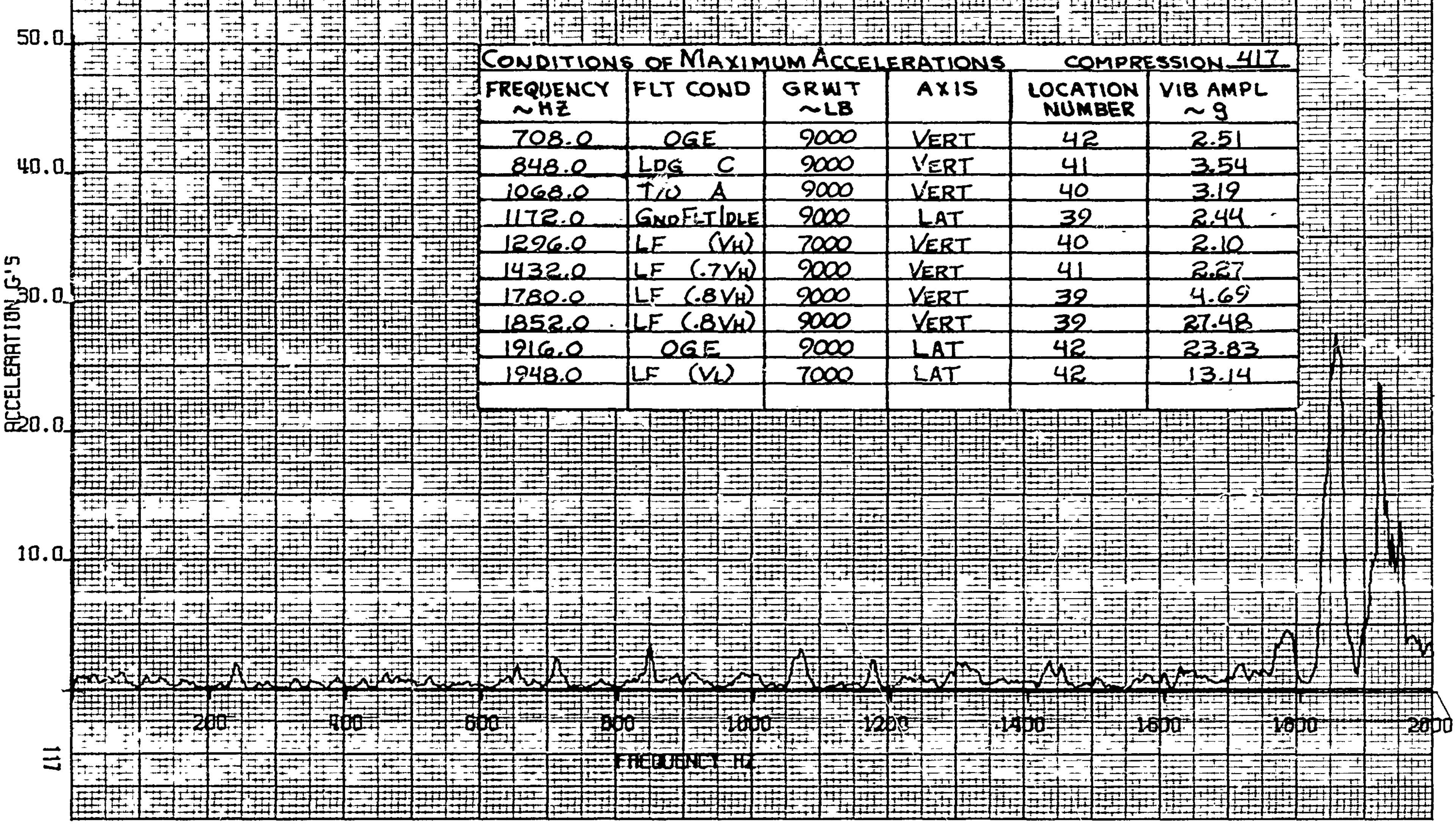
FIG 35

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON

ALL FLT CONDS TAIL ROTOR SHAFT HGR BRGS VIB ALL AXIS COMPRESSION 417



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 417

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
708.0	OGE	9000	VERT	42	2.51
848.0	LDG C	9000	VERT	41	3.54
1068.0	T/O A	9000	VERT	40	3.19
1172.0	GND FLT IDLE	9000	LAT	39	2.44
1296.0	LF (VH)	7000	VERT	40	2.10
1432.0	LF (.7VH)	9000	VERT	41	2.27
1780.0	LF (.8VH)	9000	VERT	39	4.69
1852.0	LF (.8VH)	9000	VERT	39	27.48
1916.0	OGE	9000	LAT	42	23.83
1948.0	LF (VL)	7000	LAT	42	13.14

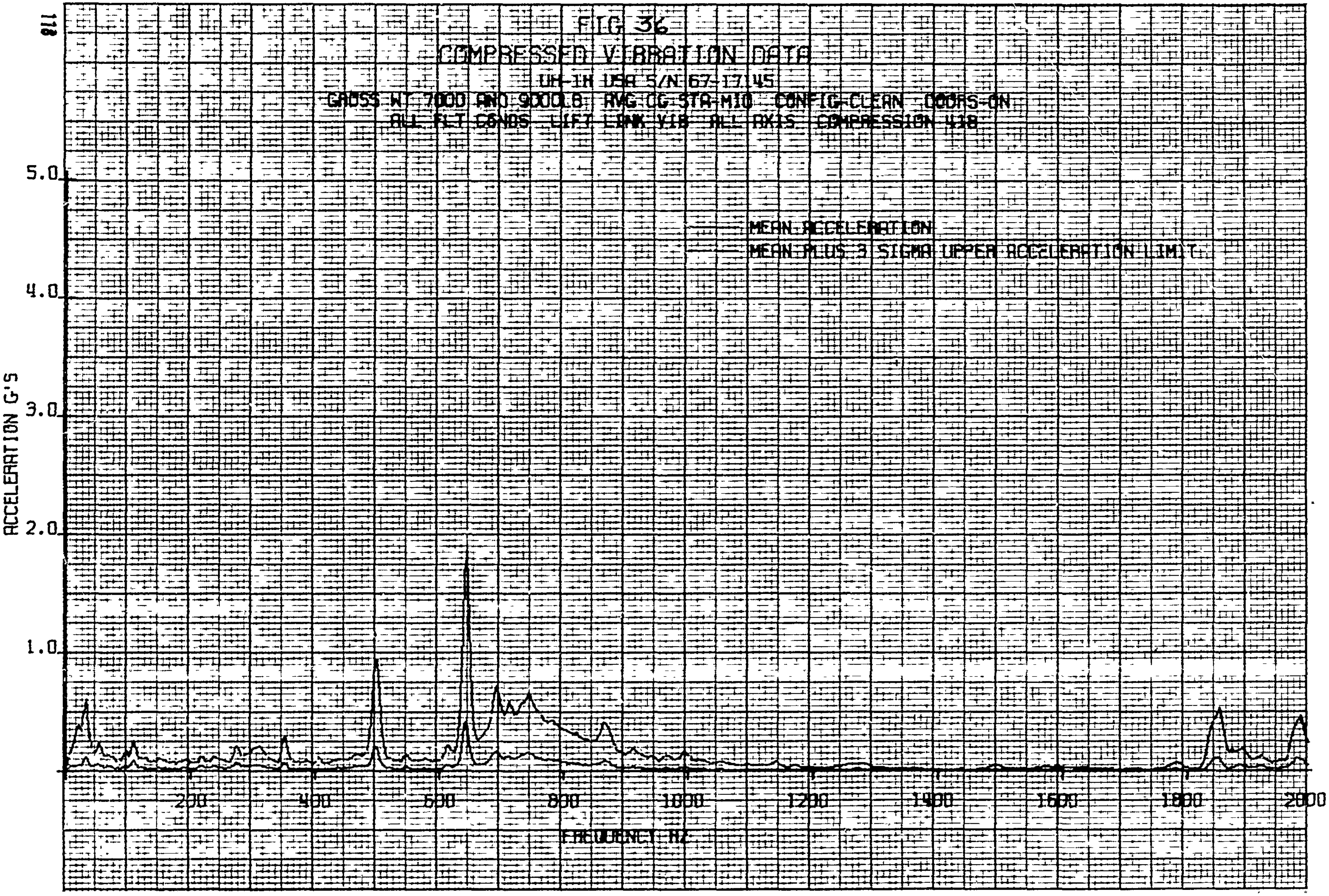


FIG 36
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
ALL FLT CONDS LIFT LINK VIB ALL AXIS COMPRESSION 418
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
5.0
4.0
3.0
2.0
1.0
ACCELERATION G'S
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

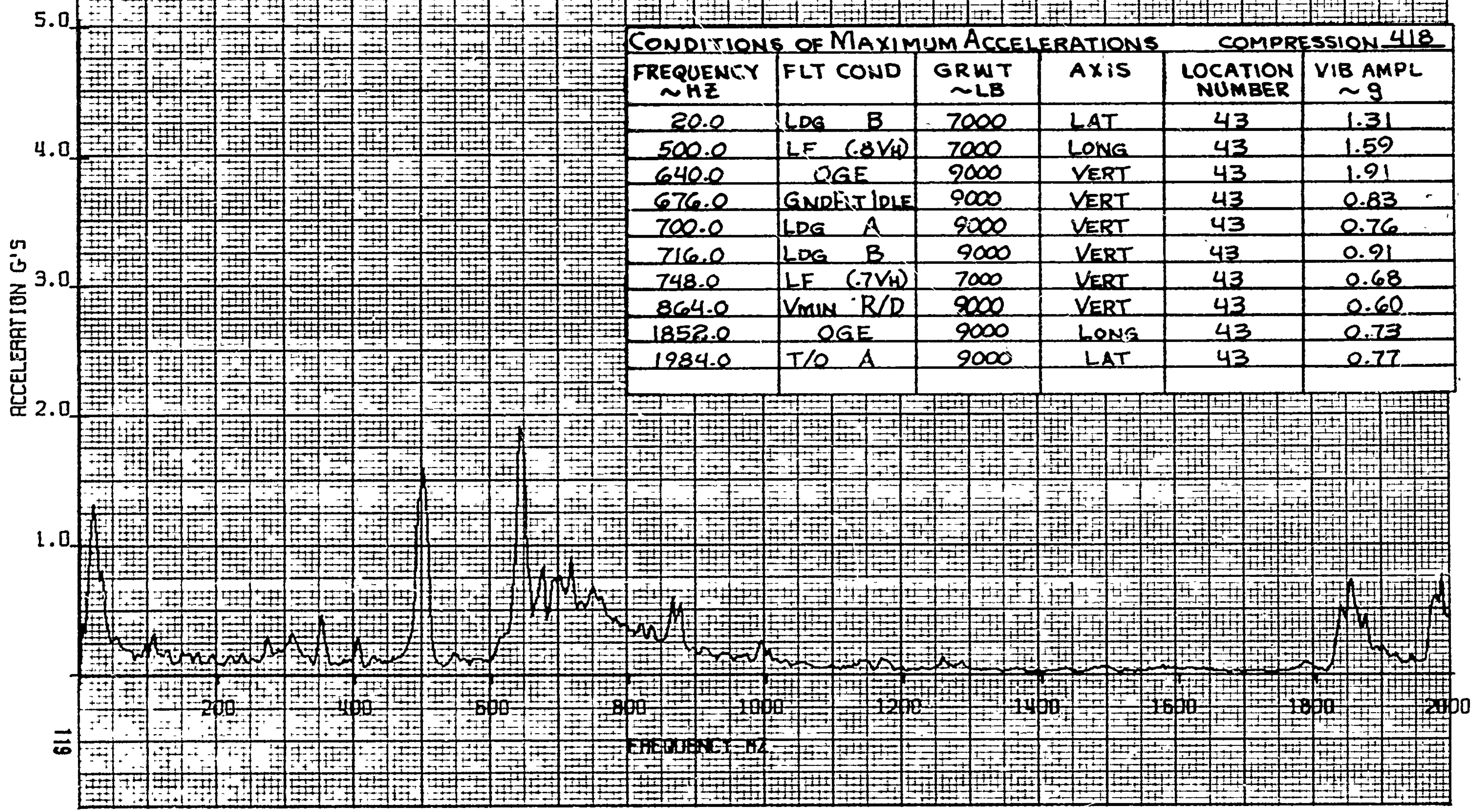
FIG 37

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000LB, AVG CG STA MID CONFIG CLEAN DOORS ON

ALL FLT CONDS LHF LINK VIB ALL AXIS COMPRESSION 418



CONDITIONS OF MAXIMUM ACCELERATIONS				COMPRESSION 418	
FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
20.0	LDG B	7000	LAT	43	1.31
500.0	LF (.8VH)	7000	LONG	43	1.59
640.0	OGE	9000	VERT	43	1.91
676.0	GNDFLT IDLE	9000	VERT	43	0.83
700.0	LDG A	9000	VERT	43	0.76
716.0	LDG B	9000	VERT	43	0.91
748.0	LF (.7VH)	7000	VERT	43	0.68
864.0	VMIN R/D	9000	VERT	43	0.60
1852.0	OGE	9000	LONG	43	0.73
1984.0	T/O A	9000	LAT	43	0.77

FIG 38

COMPRESSED VIBRATION DATA

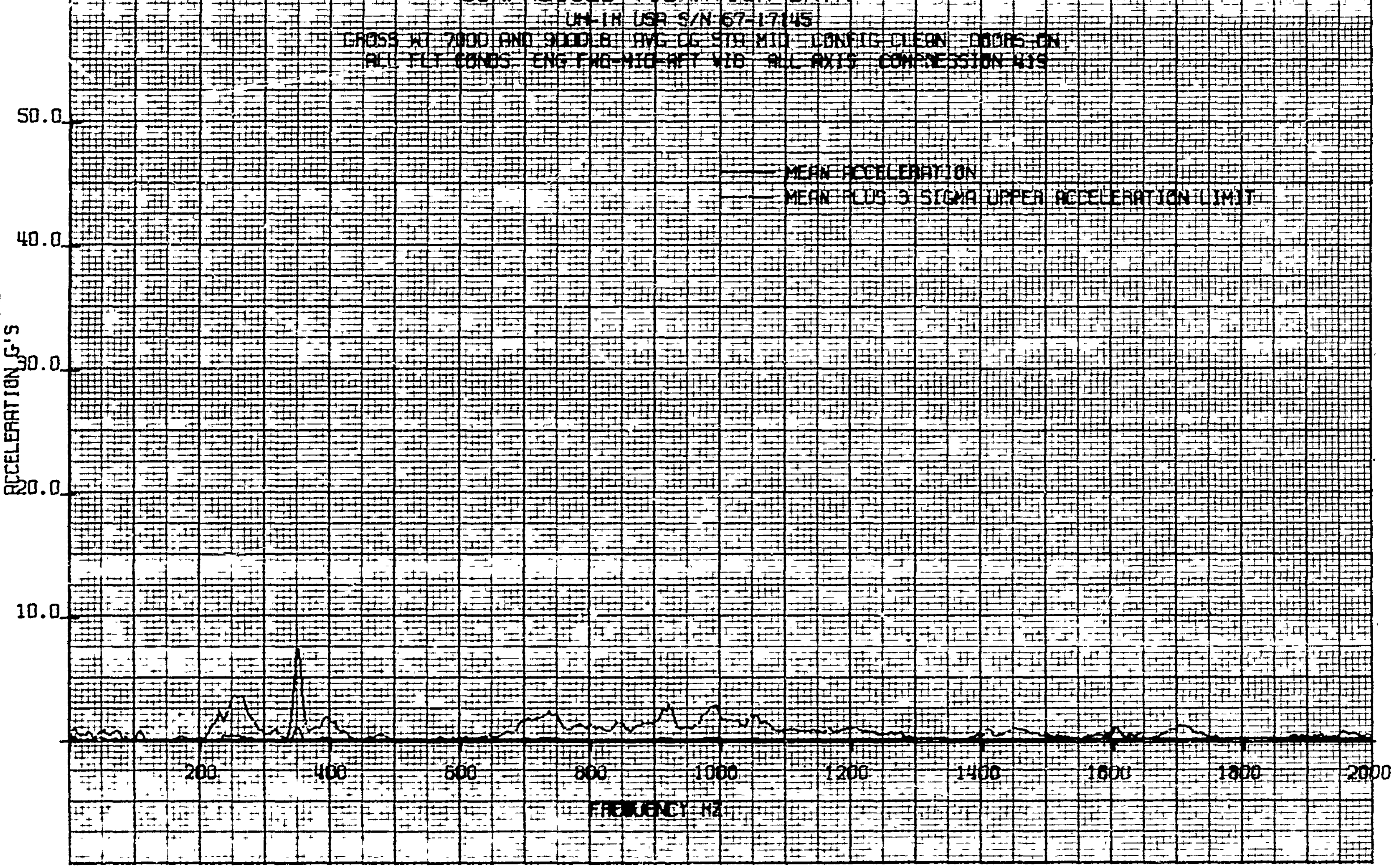


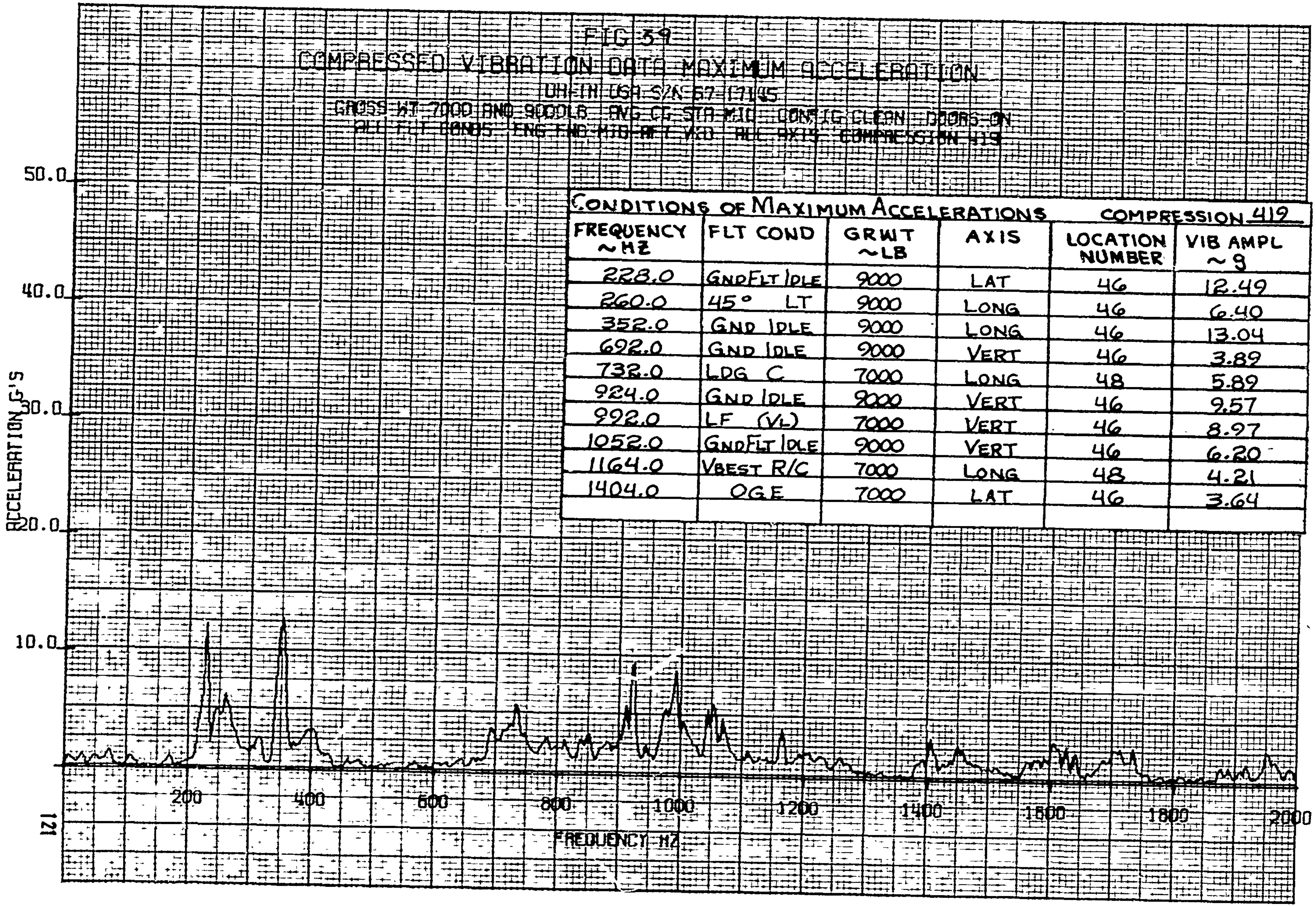
FIG 39

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000LB AVG CG STA MID CONFIG CLEAN DOORS ON
ALL FLT CONDS ENG MID-AFT XMD ALL AXIS COMPRESSION 419

CONDITIONS OF MAXIMUM ACCELERATIONS				COMPRESSION 419	
FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
228.0	GND FLT IDLE	9000	LAT	46	12.49
260.0	45° LT	9000	LONG	46	6.40
352.0	GND IDLE	9000	LONG	46	13.04
692.0	GND IDLE	9000	VERT	46	3.89
732.0	LDG C	7000	LONG	48	5.89
924.0	GND IDLE	9000	VERT	46	9.57
992.0	LF (VL)	7000	VERT	46	8.97
1052.0	GND FLT IDLE	9000	VERT	46	6.20
1164.0	VBEST R/C	7000	LONG	48	4.21
1404.0	OGE	7000	LAT	46	3.64



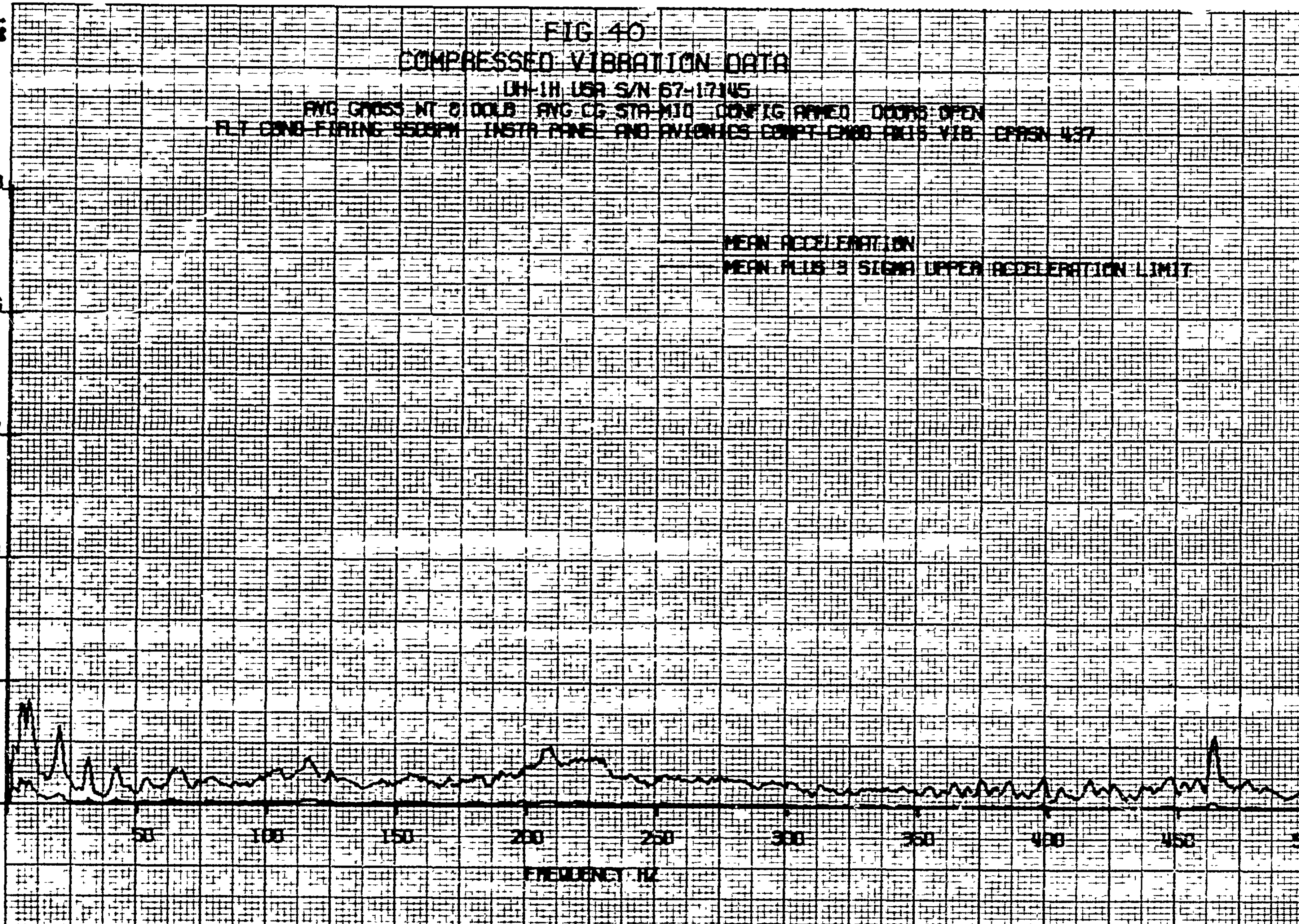


FIG 40
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-M10 CONFIG ARMED DOORS OPEN
FLT COND-FIRING 550RPM INSTR PANEL AND AVIONICS COMPT-EMBD AXIS VIB EPASN 437

FIG 41

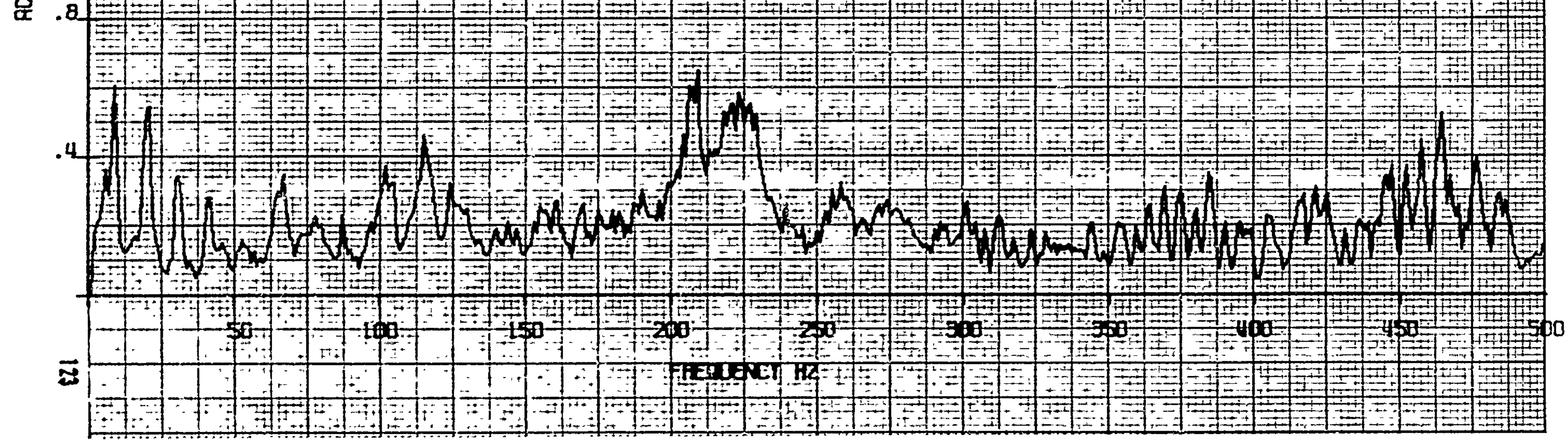
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 57-17145

AVG GROSS WT 8100LB AVG CG STA-MID CONFIG ARMED DOORS OPEN

FLT COND FIRING 5500RPM INSTR PANEL AND AVIONICS COMPT CMBD AXIS VIB CPRSN 437

CONDITIONS OF MAXIMUM ACCELERATIONS				COMPRESSION 437	
FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
9.0	LT GUN MID	8100	LAT	4	0.61
21.0	LT GUN MID	8100	VERT	6	0.54
102.0	BOTH GUNS FWD	8100	VERT	9	0.36
115.0	LT GUN FWD	8100	LONG	5	0.46
209.0	RT GUN FWD	8100	LONG	3	0.65
223.0	LT GUN FWD	8100	LONG	3	0.58
447.0	BOTH GUNS FWD	8100	VERT	7	0.37
457.0	BOTH GUNS FWD	8100	VERT	7	0.45
464.0	LT GUN AFT	8100	LAT	8	0.52
476.0	LT GUN FWD	8100	VERT	7	0.40



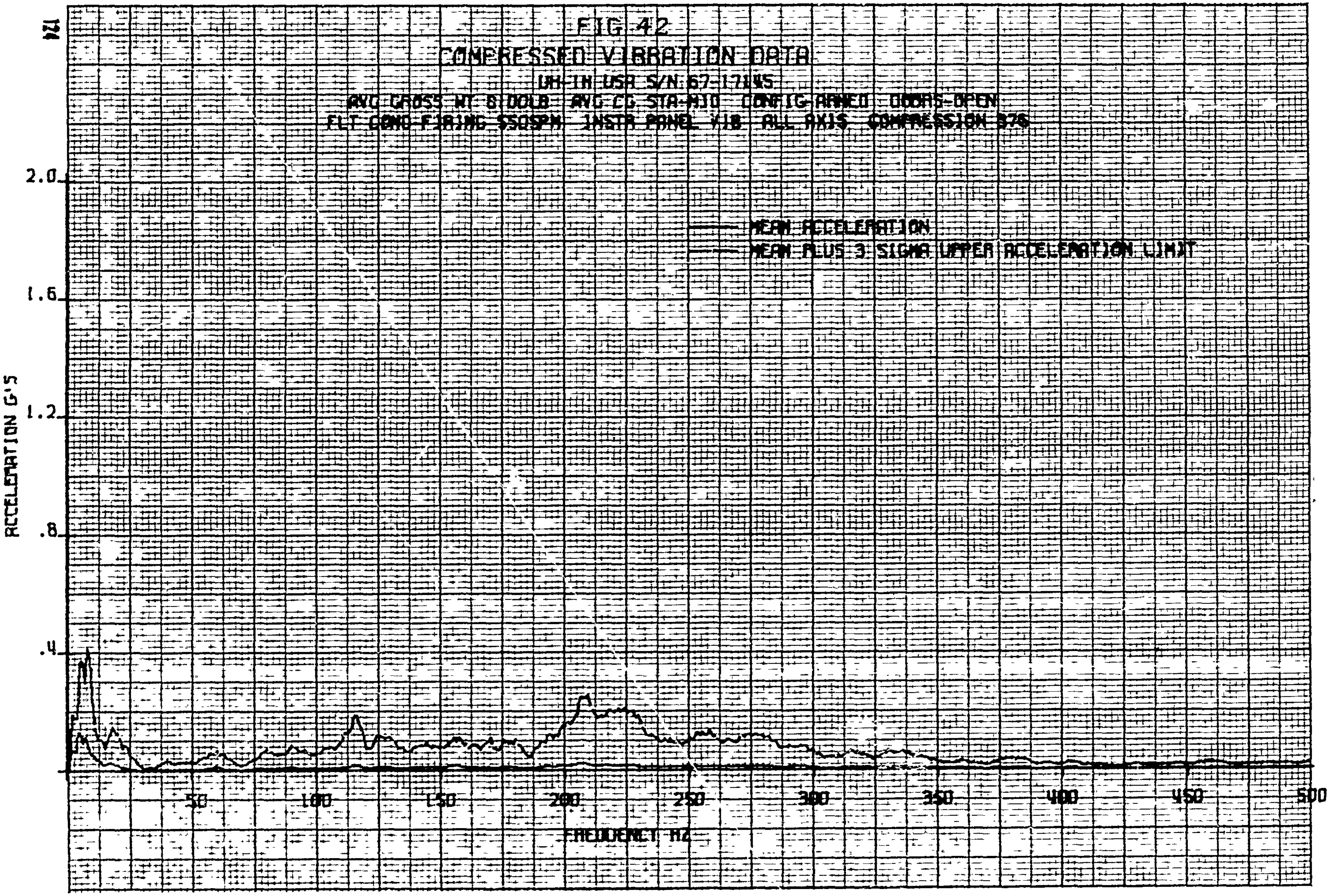


FIG 42
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-130 CONFIG-ARMED DOORS-OPEN
FLT COND-FIRING 550SPM INSTR PANEL V18 ALL AXIS COMPRESSION 376
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

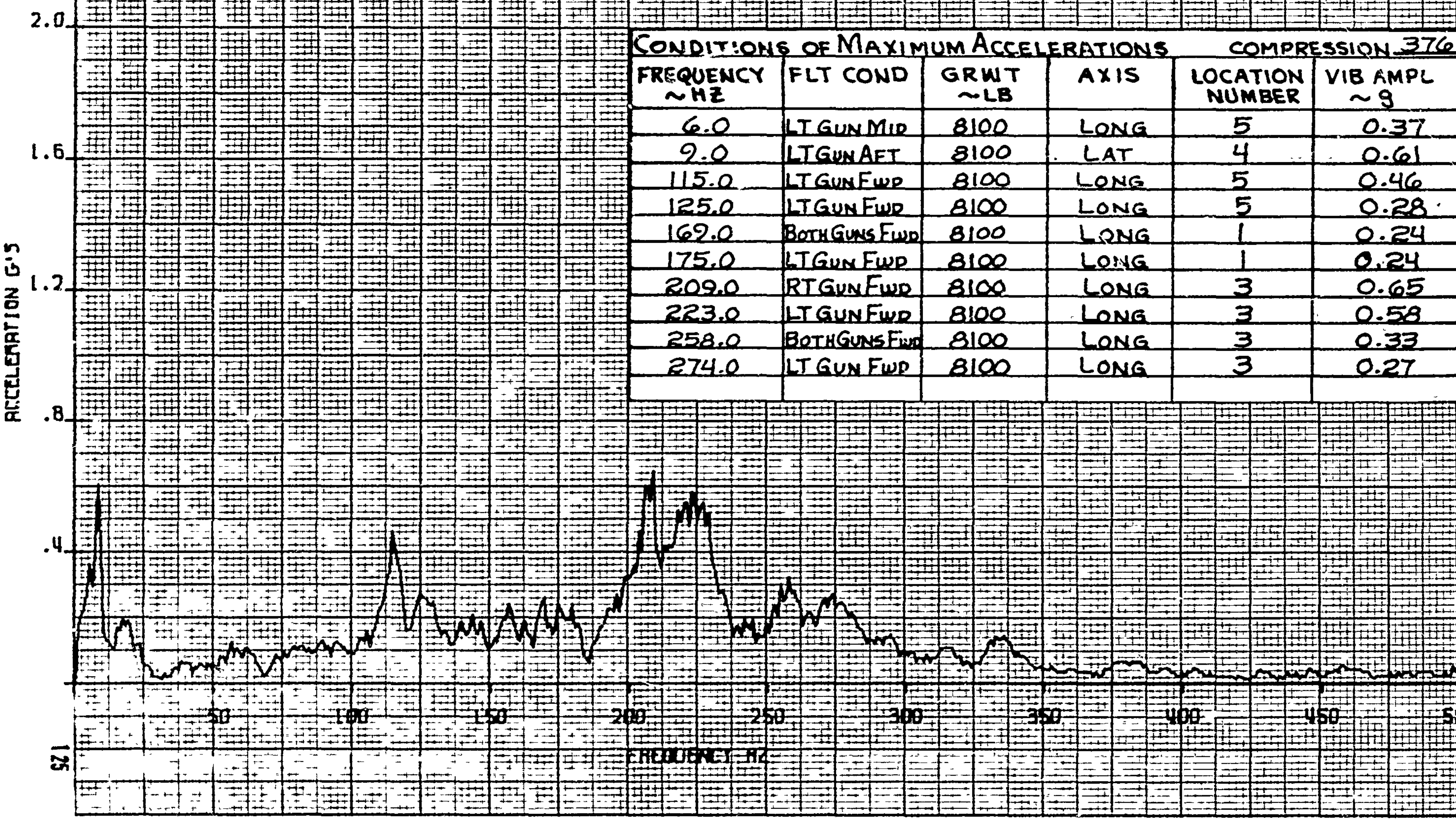
FIG 43

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN

FLT COND FIRING 550SPM INSTR PANEL VIB ALL AXIS COMPRESSION 376



CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 376

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
6.0	LT GUN MID	8100	LONG	5	0.37
9.0	LT GUN AFT	8100	LAT	4	0.61
115.0	LT GUN FWD	8100	LONG	5	0.46
125.0	LT GUN FWD	8100	LONG	5	0.28
169.0	BOTH GUNS FWD	8100	LONG	1	0.24
175.0	LT GUN FWD	8100	LONG	1	0.24
209.0	RT GUN FWD	8100	LONG	3	0.65
223.0	LT GUN FWD	8100	LONG	3	0.58
258.0	BOTH GUNS FWD	8100	LONG	3	0.33
274.0	LT GUN FWD	8100	LONG	3	0.27

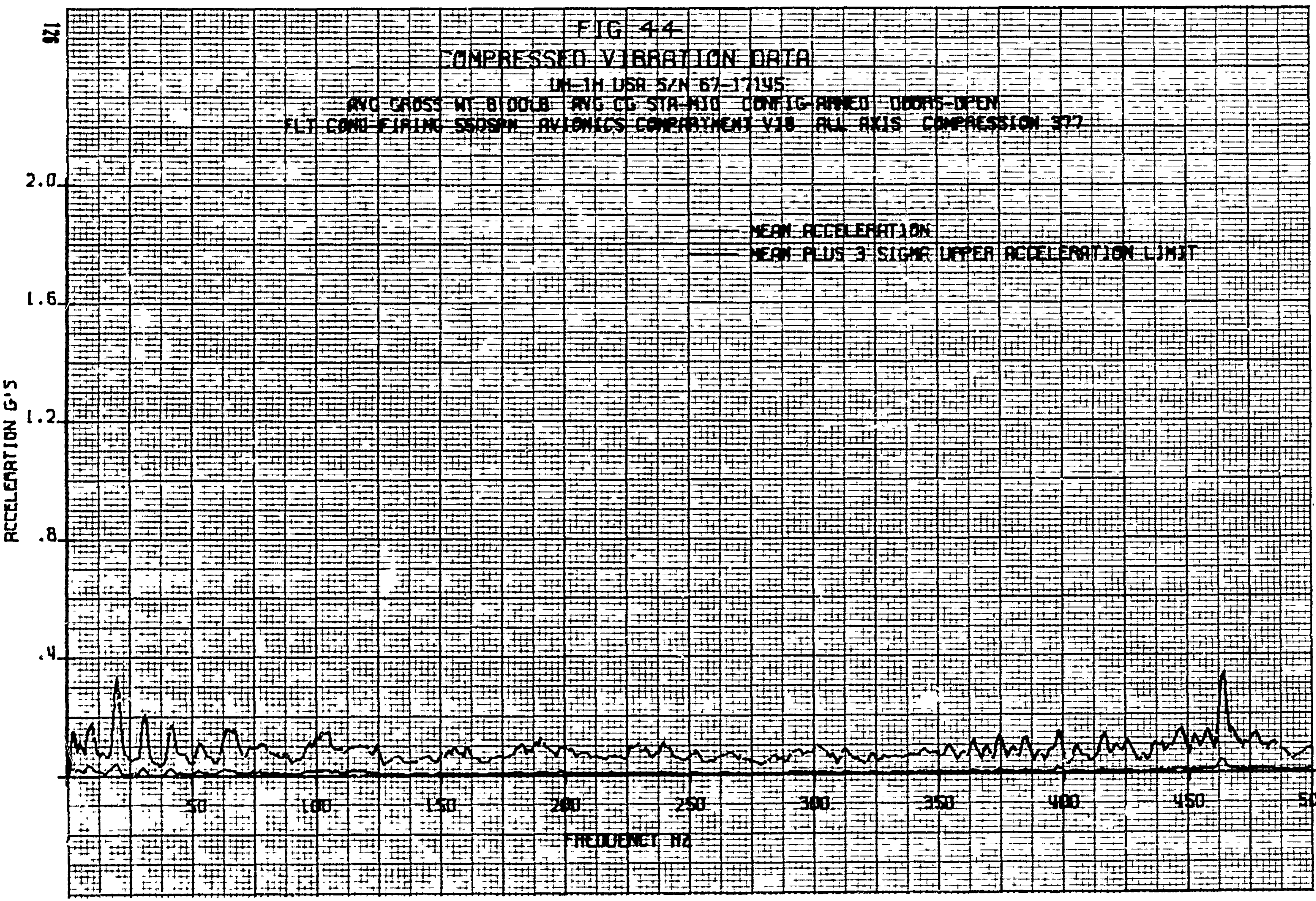


FIG 44
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN
FLT COND-FIRING AVIONICS COMPARTMENT V18 ALL AXIS COMPRESSION
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

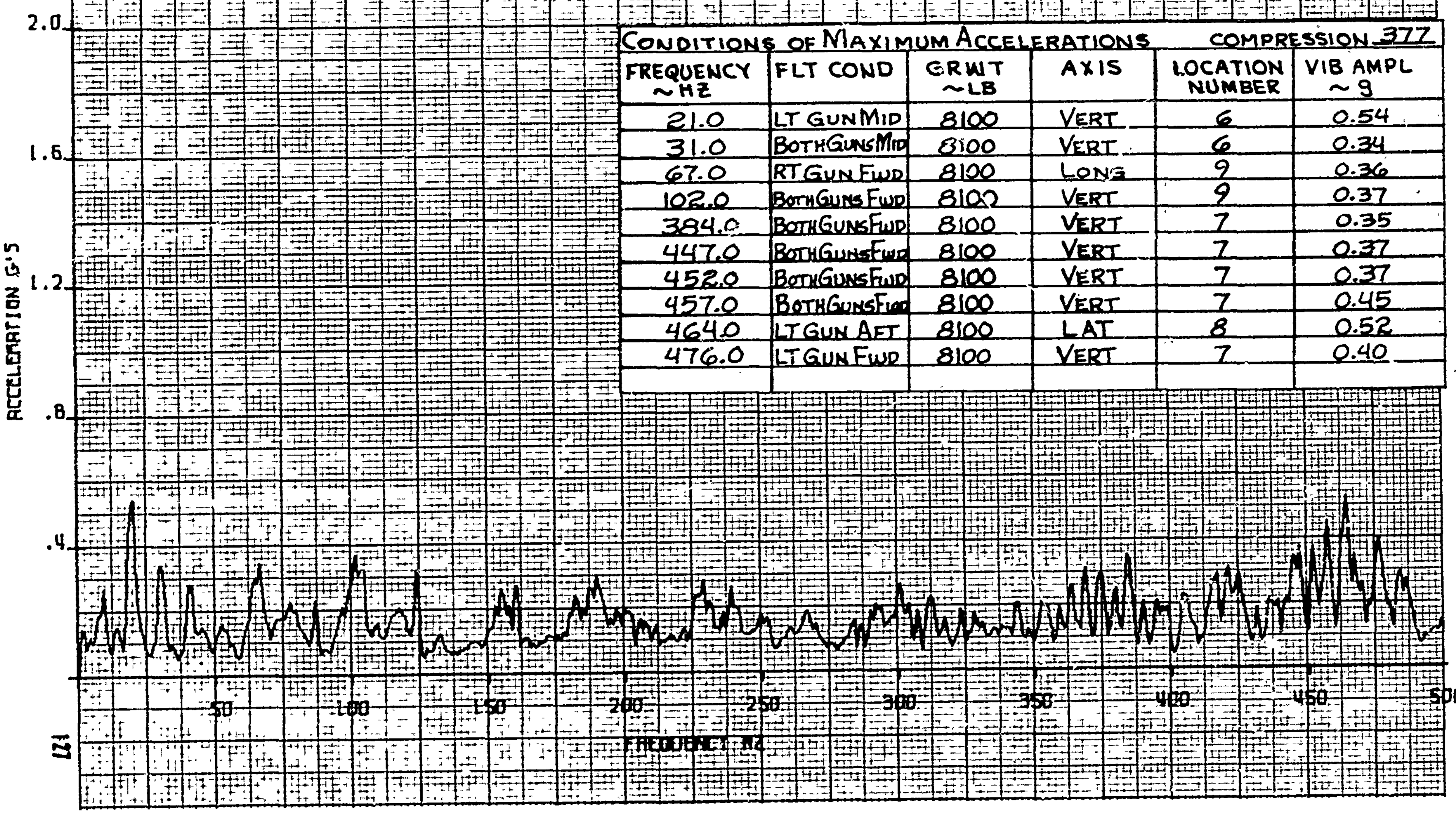
FIG 45

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN

FLT COND FIRING 550SPM AVIONICS COMPARTMENT VIB ALL AXIS COMPRESSION 377



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 377

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
21.0	LT GUN MID	8100	VERT	6	0.54
31.0	BOTH GUNS MID	8100	VERT	6	0.34
67.0	RT GUN FWD	8100	LONG	9	0.36
102.0	BOTH GUNS FWD	8100	VERT	9	0.37
384.0	BOTH GUNS FWD	8100	VERT	7	0.35
447.0	BOTH GUNS FWD	8100	VERT	7	0.37
452.0	BOTH GUNS FWD	8100	VERT	7	0.37
457.0	BOTH GUNS FWD	8100	VERT	7	0.45
464.0	LT GUN AFT	8100	LAT	8	0.52
476.0	LT GUN FWD	8100	VERT	7	0.40

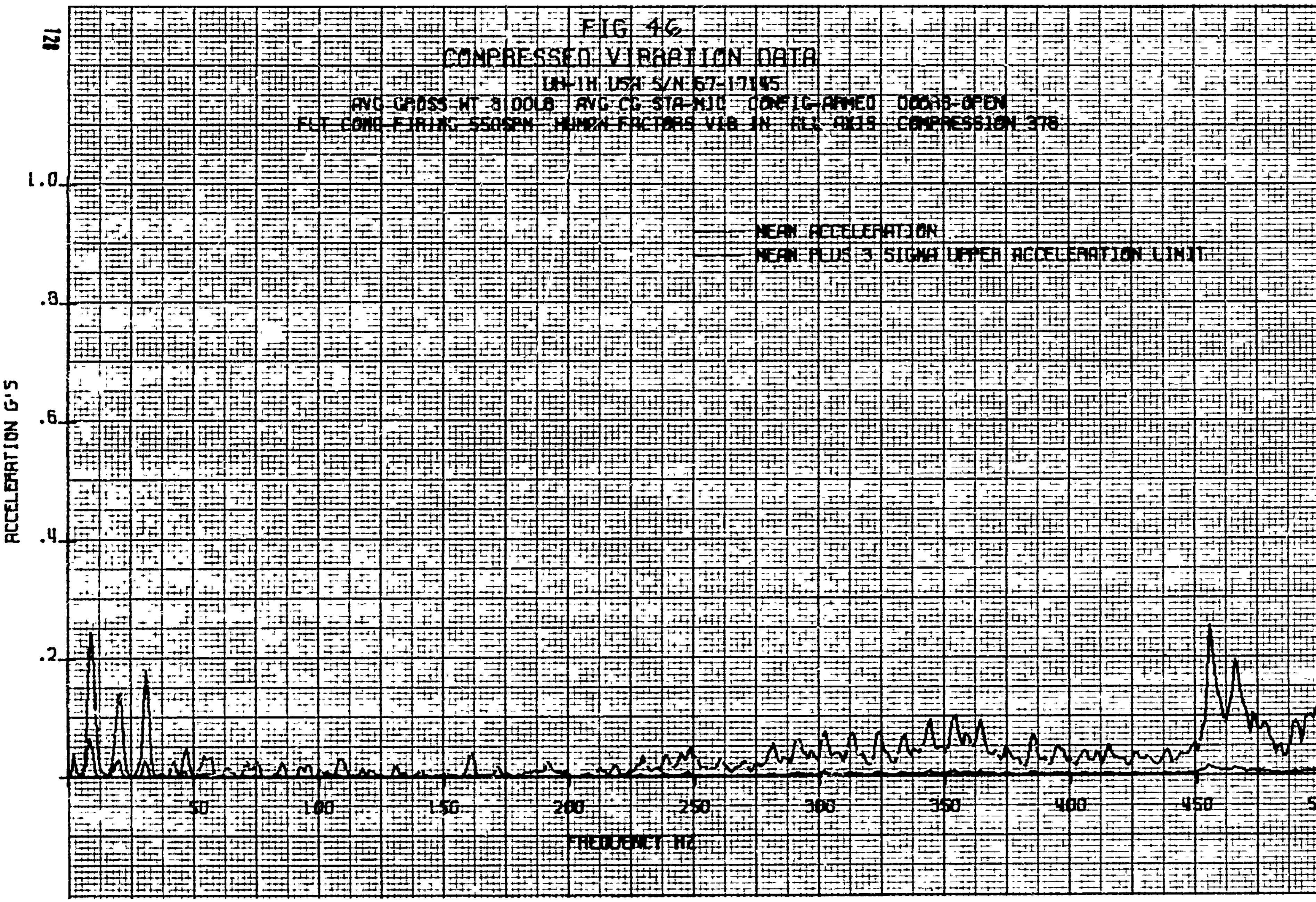


FIG 46
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN
FLT COND-FIRING 550SPN HUMAN FACTORS VIB IN ALL AXIS COMPRESSION 378
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

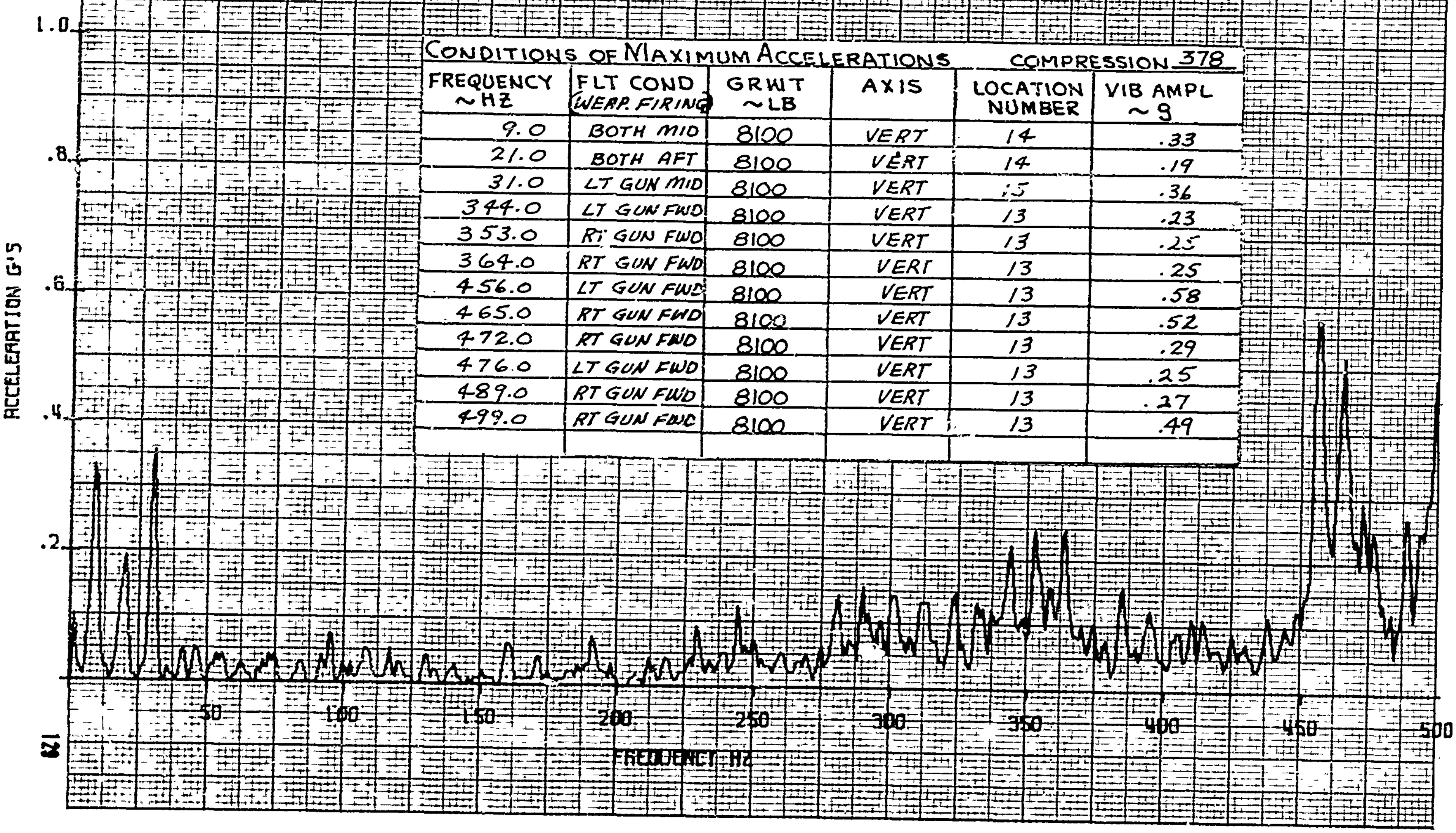
FIG 47

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN

FLT COND-FIRING 550SPM HUMAN FACTORS VIB IN ALL AXIS COMPRESSION 378



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 378

FREQUENCY ~HZ	FLT COND (WEAP. FIRING)	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
9.0	BOTH MID	8100	VERT	14	.33
21.0	BOTH AFT	8100	VERT	14	.19
31.0	LT GUN MID	8100	VERT	15	.36
344.0	LT GUN FWD	8100	VERT	13	.23
353.0	RT GUN FWD	8100	VERT	13	.25
364.0	RT GUN FWD	8100	VERT	13	.25
456.0	LT GUN FWD	8100	VERT	13	.58
465.0	RT GUN FWD	8100	VERT	13	.52
472.0	RT GUN FWD	8100	VERT	13	.29
476.0	LT GUN FWD	8100	VERT	13	.25
489.0	RT GUN FWD	8100	VERT	13	.27
499.0	RT GUN FWD	8100	VERT	13	.49

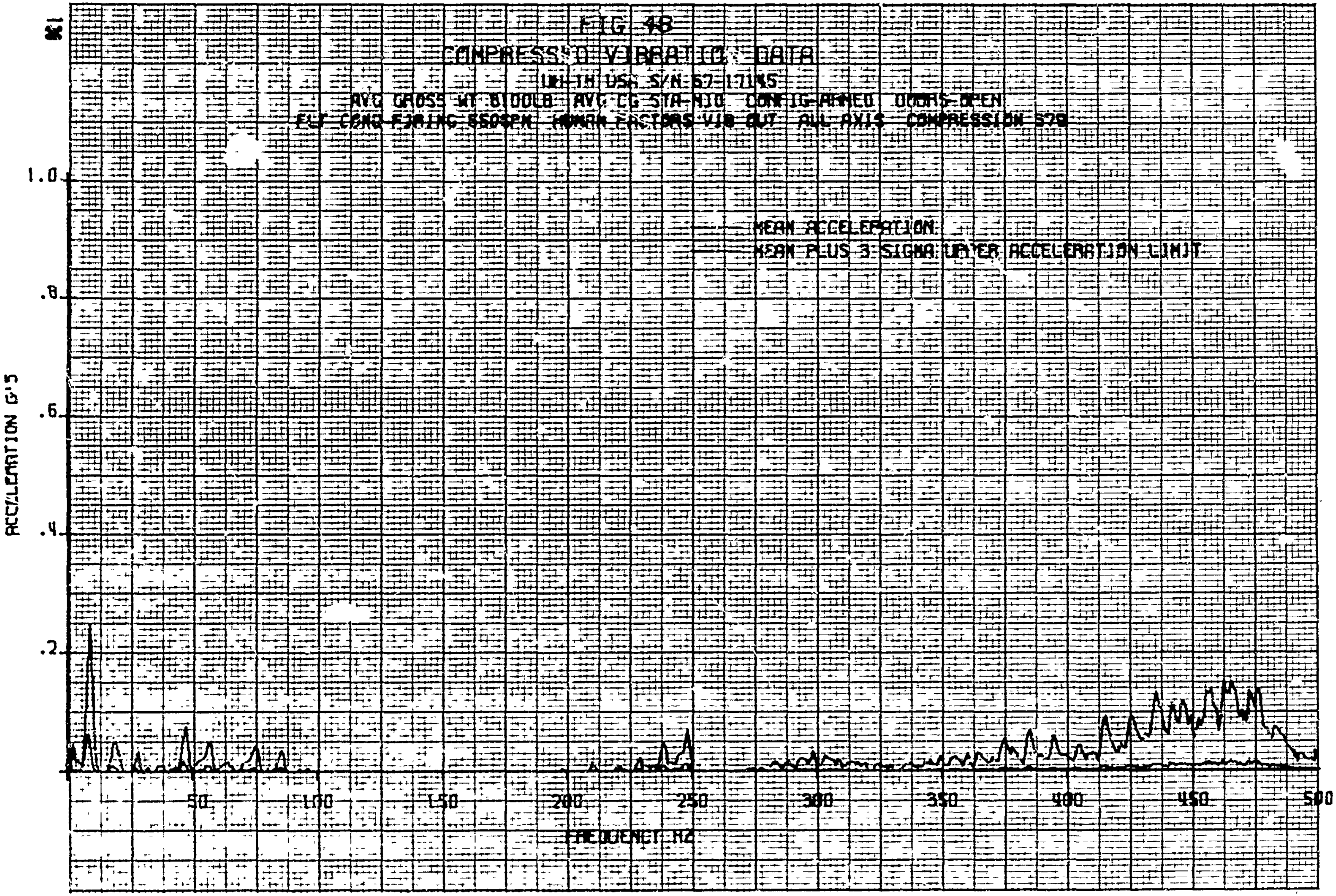


FIG 48
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-N10 CONFIG-ARMED DOORS-OPEN
FLT COND-FIRING 550SPM HUMAN FACTORS VIB OUT ALL AXIS COMPRESSION 578
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
1.0
.8
.6
.4
.2
ACCELERATION G'S
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

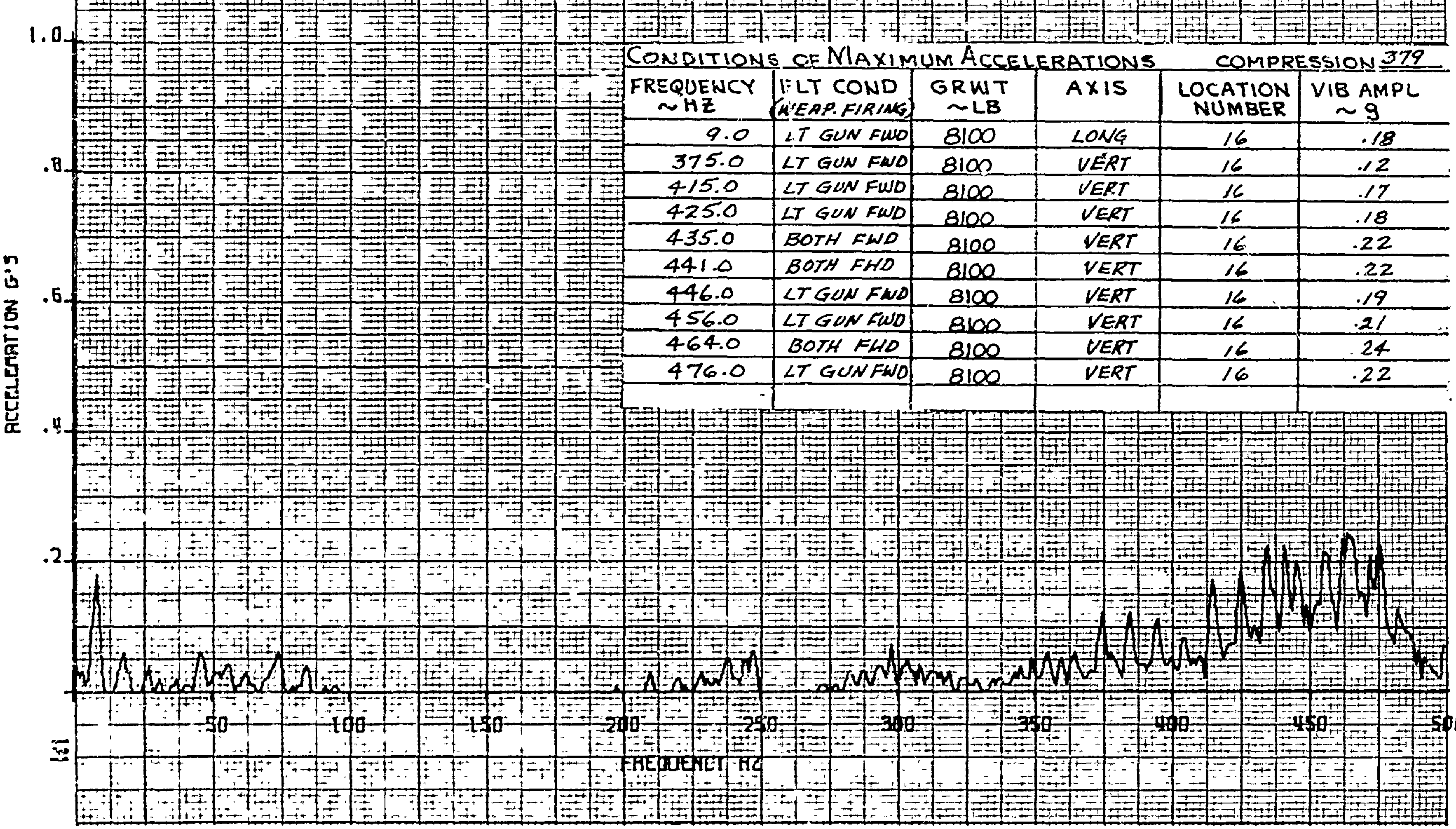
FIG 49

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-[illegible] CONFIG-ARMED DOORS-OPEN

FLT COND-FIRING 550SPM HUMAN FACTORS VIB OUT ALL AXIS COMPRESSION 379



CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 379

FREQUENCY ~HZ	FLT COND (WEAP. FIRING)	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
9.0	LT GUN FWD	8100	LONG	16	.18
375.0	LT GUN FWD	8100	VERT	16	.12
415.0	LT GUN FWD	8100	VERT	16	.17
425.0	LT GUN FWD	8100	VERT	16	.18
435.0	BOTH FWD	8100	VERT	16	.22
441.0	BOTH FWD	8100	VERT	16	.22
446.0	LT GUN FWD	8100	VERT	16	.19
456.0	LT GUN FWD	8100	VERT	16	.21
464.0	BOTH FWD	8100	VERT	16	.24
476.0	LT GUN FWD	8100	VERT	16	.22

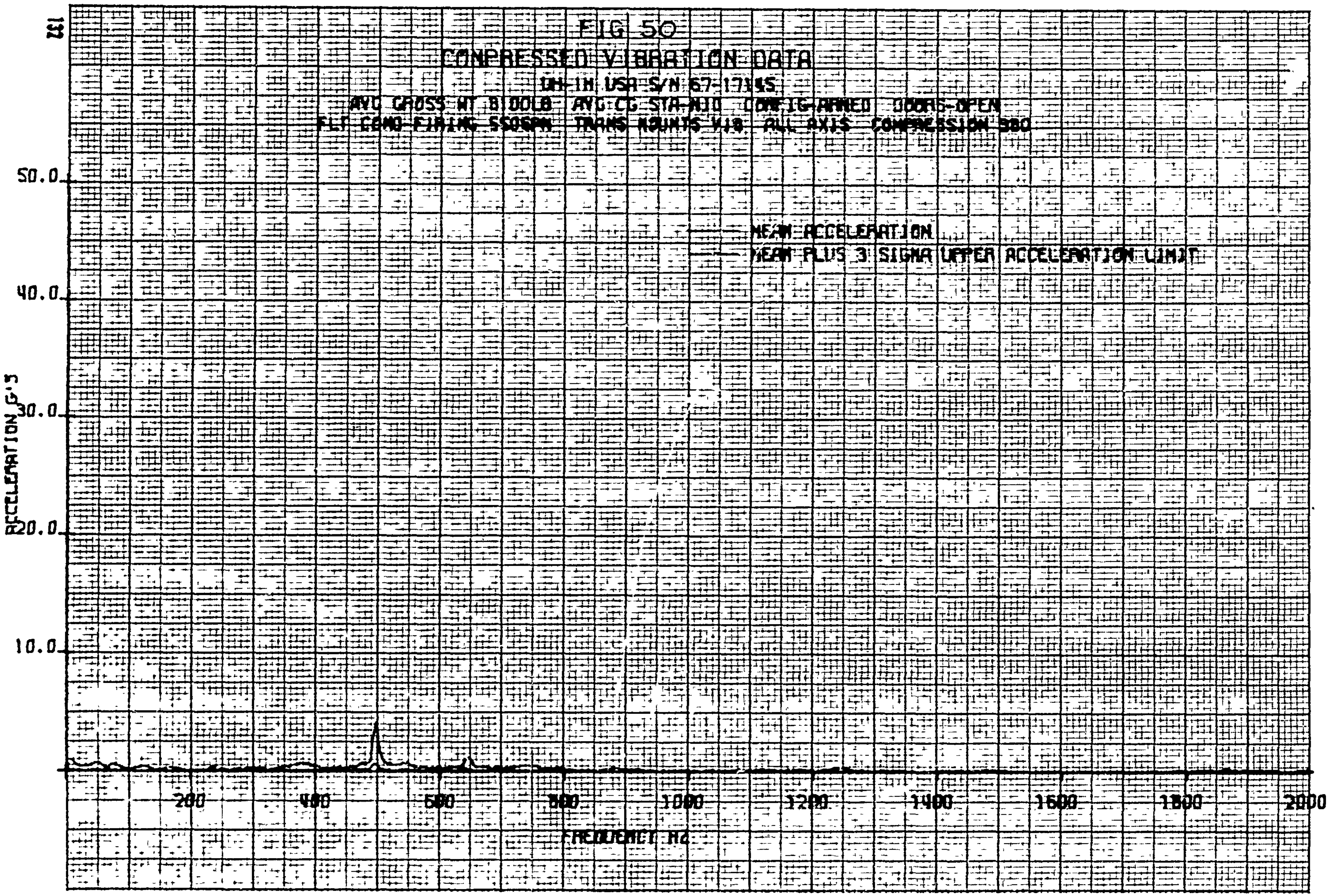


FIG 50
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-130 CONFIG-ARMED DOORS-OPEN
FLT COND-FIRING 550SPM TRANS MOUNTS V18 ALL AXIS COMPRESSION 380
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
50.0
40.0
30.0
20.0
10.0
ACCELERATION G'S
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

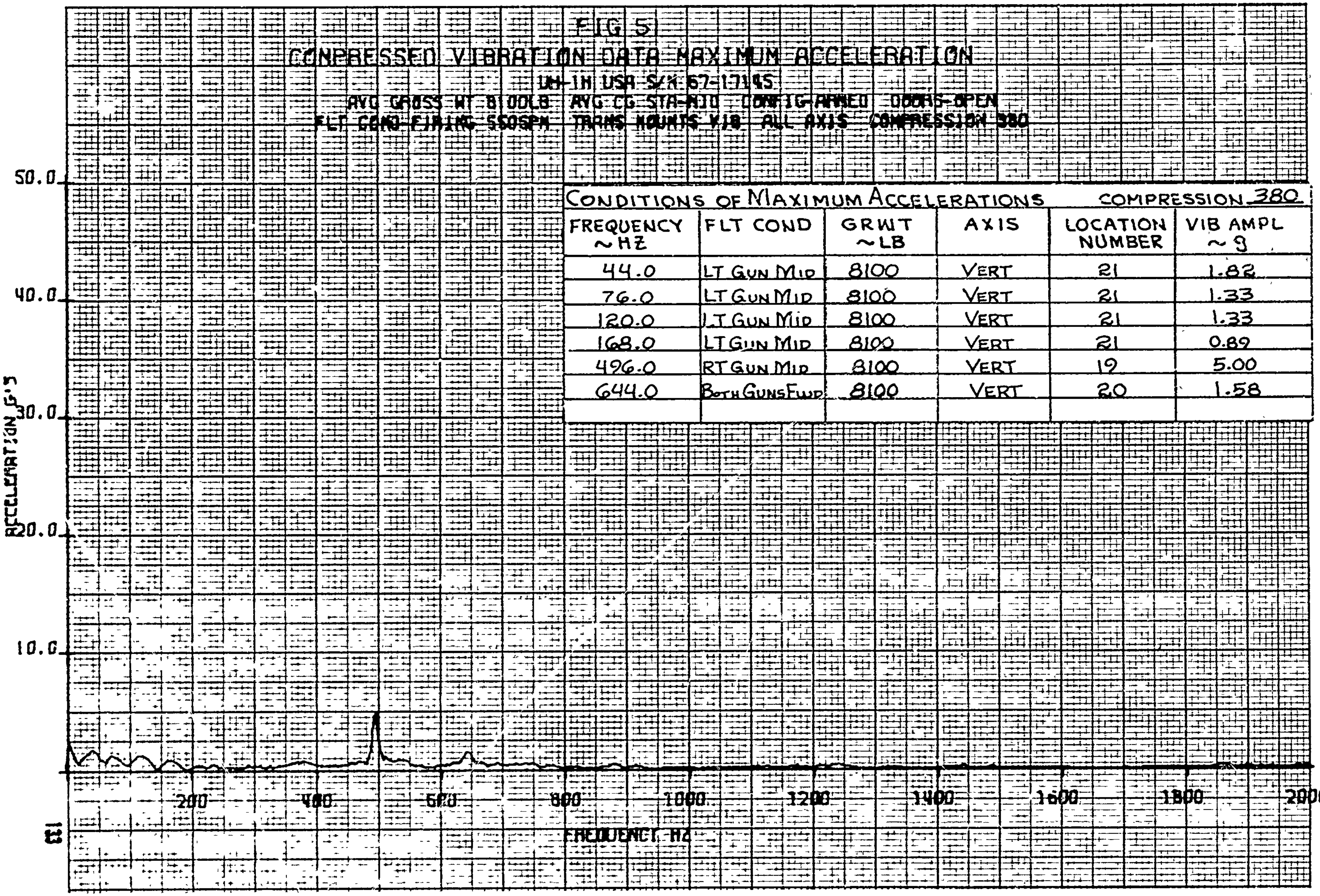
FIG 5

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN

FLT COND FIRING 550SPM TRANS MOUNTS VIB ALL AXIS COMPRESSION 380



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 380

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
44.0	LT GUN MID	8100	VERT	21	1.82
76.0	LT GUN MID	8100	VERT	21	1.33
120.0	LT GUN MID	8100	VERT	21	1.33
168.0	LT GUN MID	8100	VERT	21	0.89
496.0	RT GUN MID	8100	VERT	19	5.00
644.0	BOTH GUNS FWD	8100	VERT	20	1.58

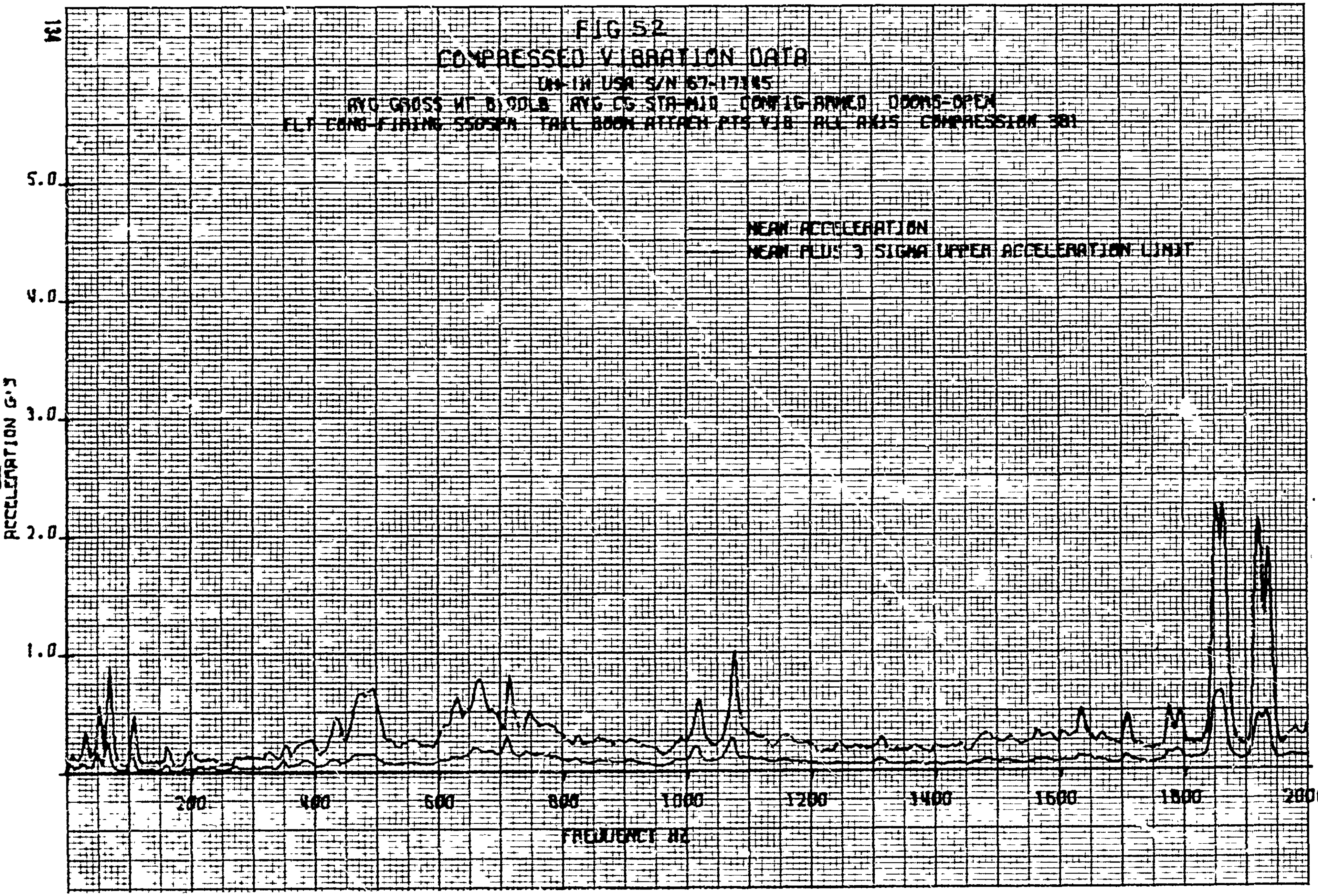


FIG 52
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17345
AVG GROSS WT 8190LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN
FLT COND-FIRING 5505PM TAIL BOOM ATTACH PTS V18 ALL AXIS COMPRESSION 381
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
5.0
4.0
3.0
2.0
1.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

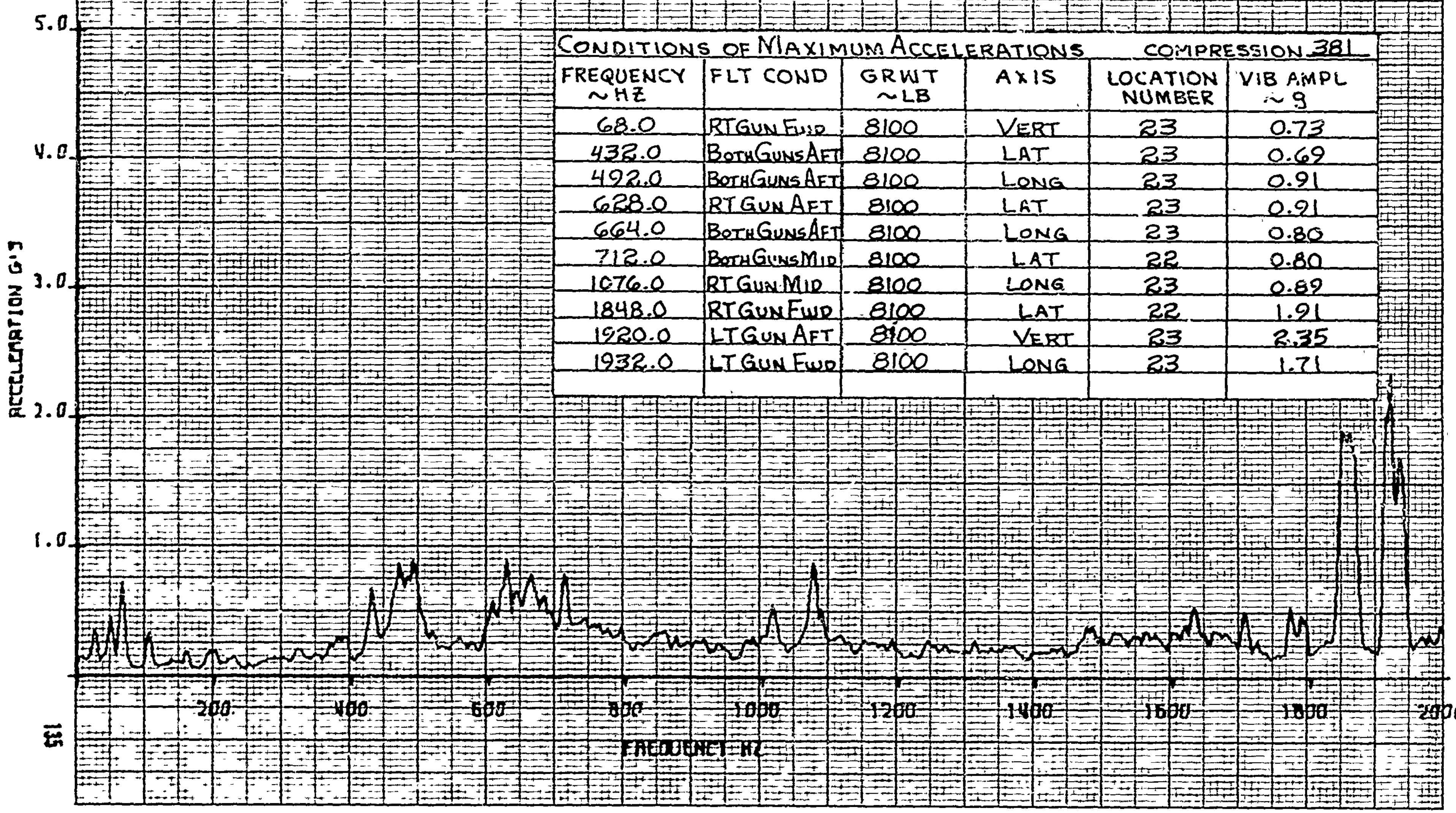
FIG 53

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN

FLT COND-FIRING 550SPM TAIL BOOM ATTACH PTS VIB ALL AXIS COMPRESSION 381



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 381

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
68.0	RT GUN FWD	8100	VERT	23	0.73
432.0	BOTH GUNS AFT	8100	LAT	23	0.69
492.0	BOTH GUNS AFT	8100	LONG	23	0.91
628.0	RT GUN AFT	8100	LAT	23	0.91
664.0	BOTH GUNS AFT	8100	LONG	23	0.80
712.0	BOTH GUNS MID	8100	LAT	22	0.80
1076.0	RT GUN MID	8100	LONG	23	0.89
1848.0	RT GUN FWD	8100	LAT	22	1.91
1920.0	LT GUN AFT	8100	VERT	23	2.35
1932.0	LT GUN FWD	8100	LONG	23	1.71

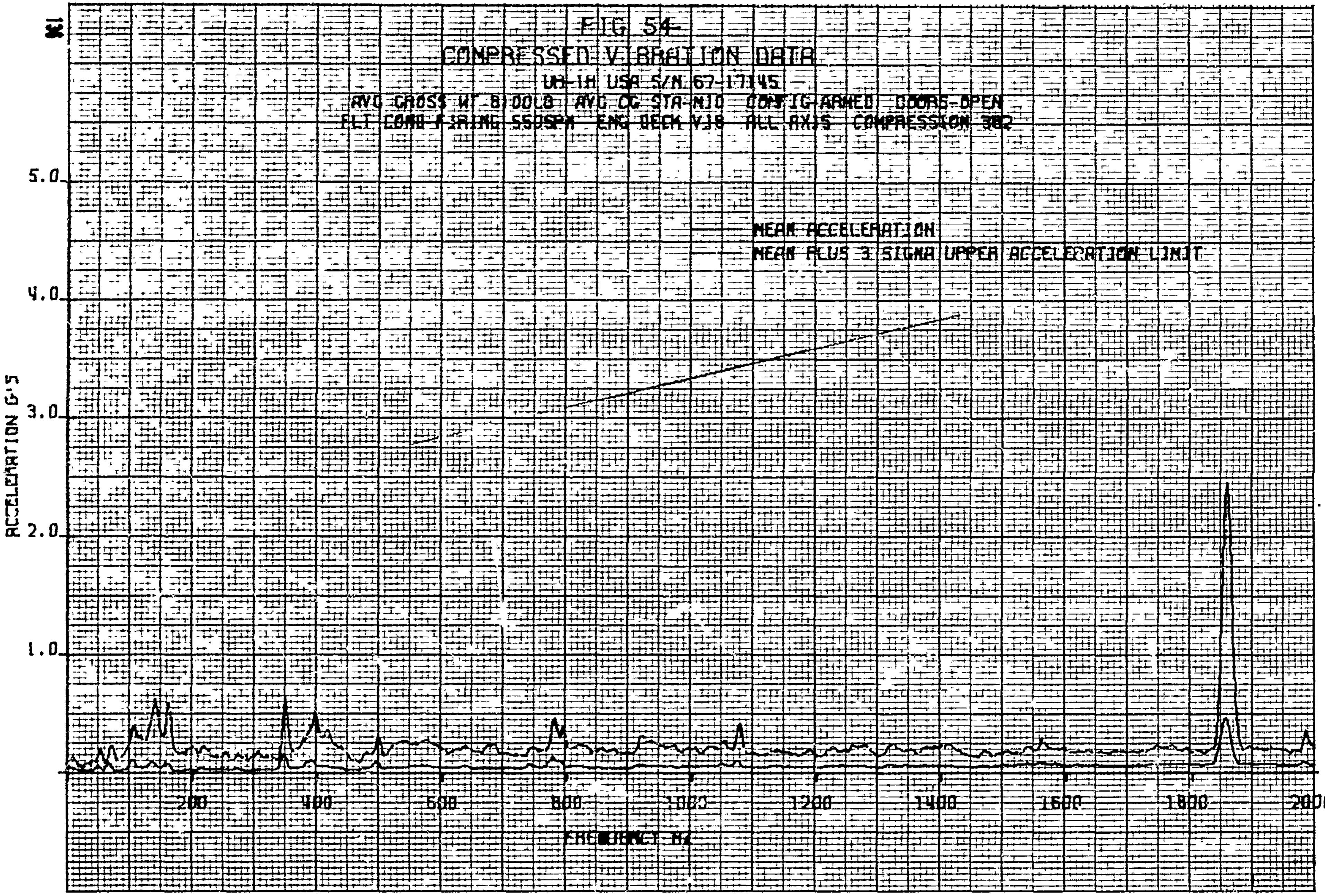


FIG 54
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN
FLT COND FIRING 550SPM ENG DECK V18 ALL AXIS COMPRESSION 3%2
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
5.0
4.0
3.0
2.0
1.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

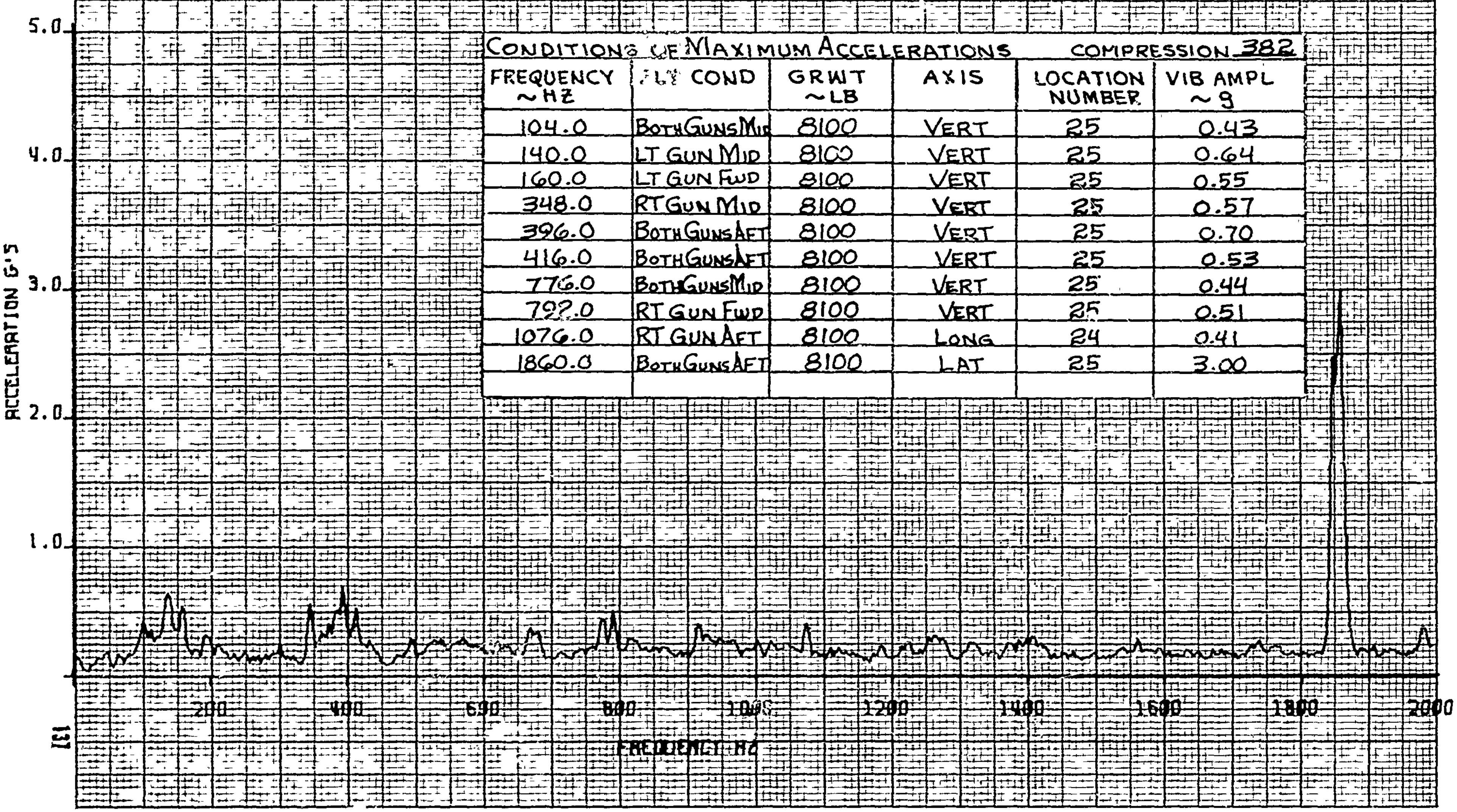
FIG 55

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-N10 CONFIG-ARMED DOORS-OPEN

FLT COND FIRING 550SPM ENG DECK VIB ALL AXIS COMPRESSION 382



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 382

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
104.0	BOTH GUNS MID	8100	VERT	25	0.43
140.0	LT GUN MID	8100	VERT	25	0.64
160.0	LT GUN FWD	8100	VERT	25	0.55
348.0	RT GUN MID	8100	VERT	25	0.57
396.0	BOTH GUNS AFT	8100	VERT	25	0.70
416.0	BOTH GUNS AFT	8100	VERT	25	0.53
776.0	BOTH GUNS MID	8100	VERT	25	0.44
792.0	RT GUN FWD	8100	VERT	25	0.51
1076.0	RT GUN AFT	8100	LONG	24	0.41
1860.0	BOTH GUNS AFT	8100	LAT	25	3.00

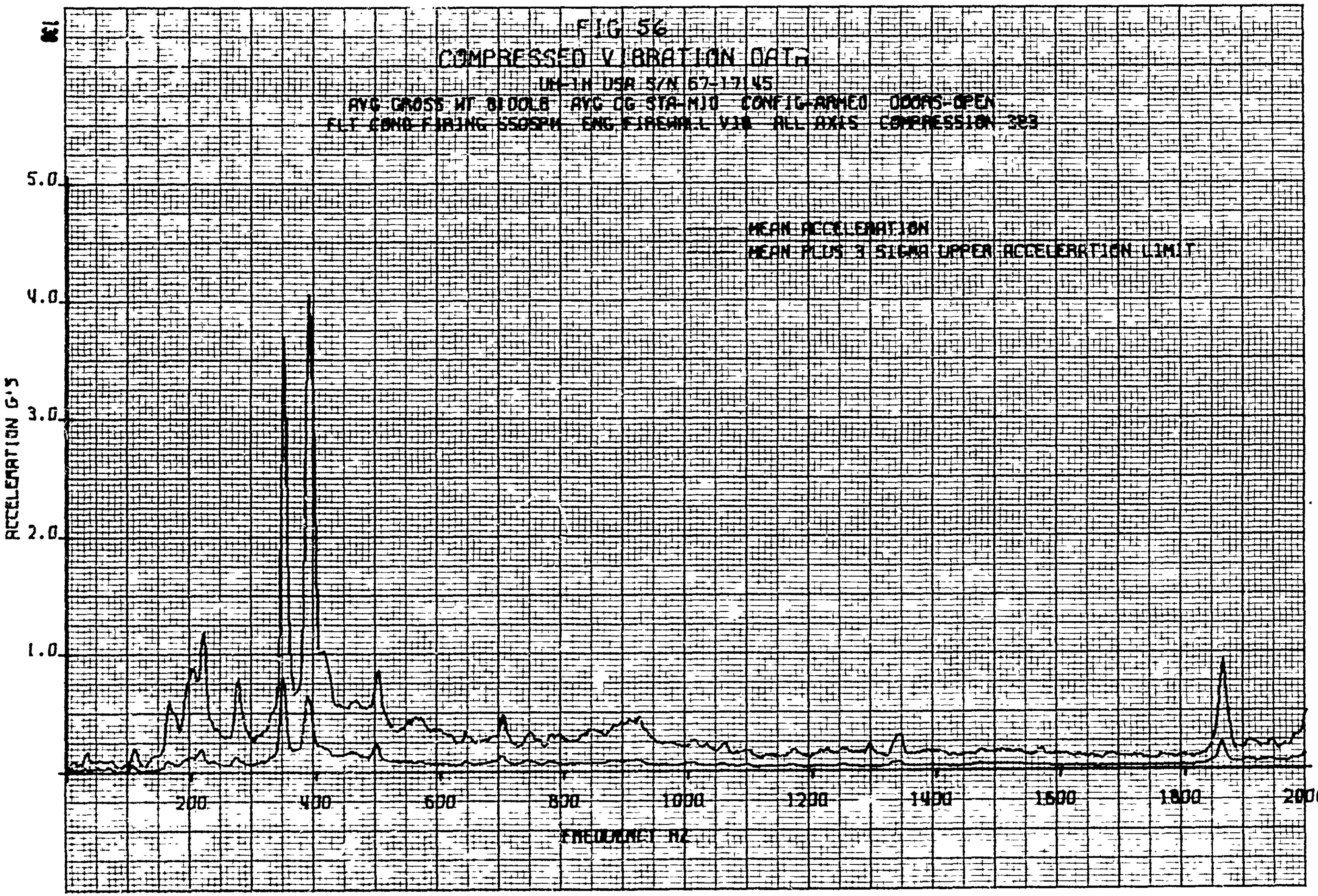
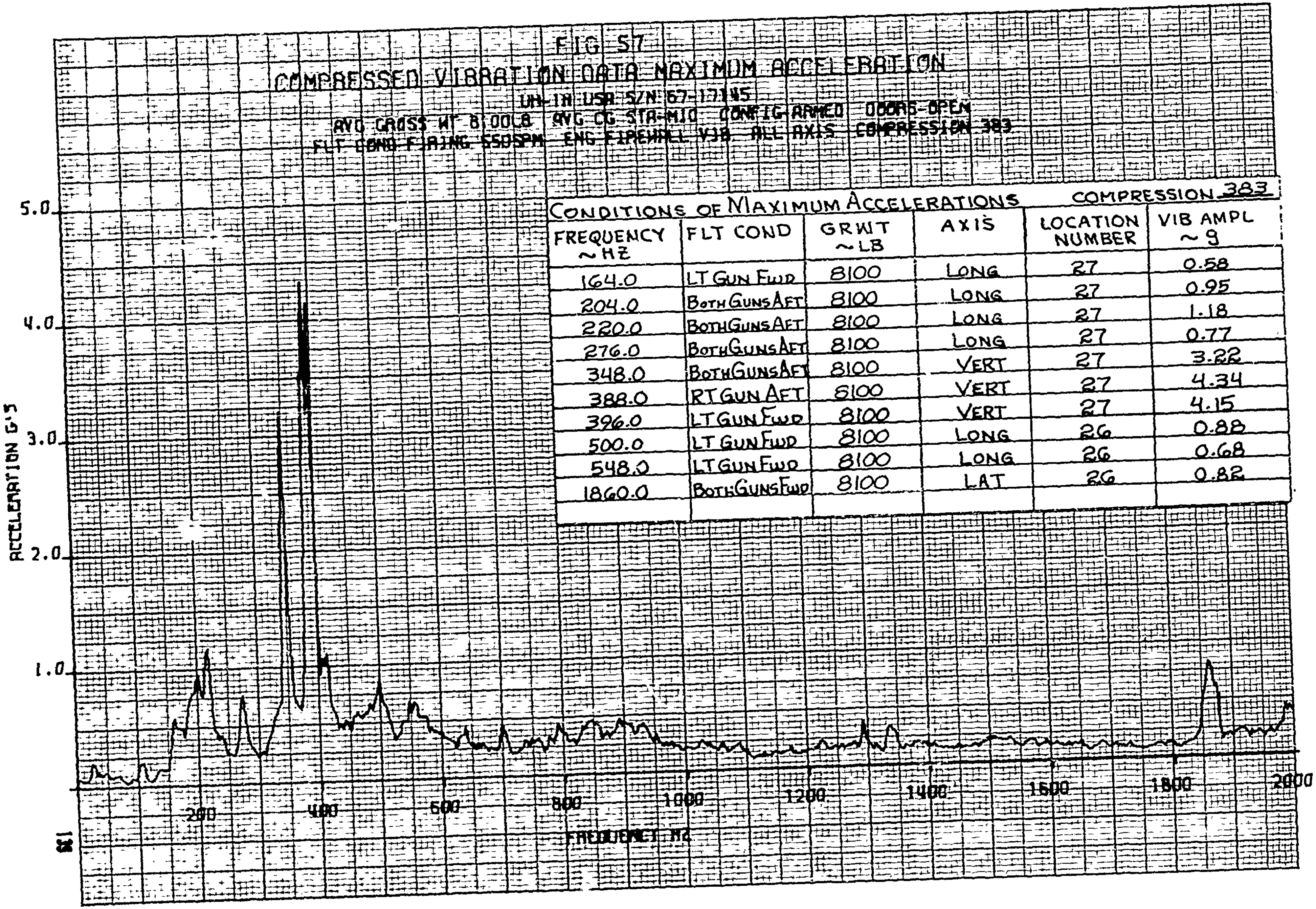


FIG 56
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN
FLT COND FIRING 550SPM ENG FIREWALL V18 ALL AXIS COMPRESSION 323
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
5.0
4.0
3.0
2.0
1.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

FIG 57
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1A USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN
FLT COND-FIRING 550SPM ENG FIREWALL VIB ALL AXIS COMPRESSION 383



CONDITIONS OF MAXIMUM ACCELERATIONS   COMPRESSION 383

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
164.0	LT GUN FWD	8100	LONG	27	0.58
204.0	BOTH GUNS AFT	8100	LONG	27	0.95
220.0	BOTH GUNS AFT	8100	LONG	27	1.18
276.0	BOTH GUNS AFT	8100	LONG	27	0.77
348.0	BOTH GUNS AFT	8100	VERT	27	3.22
388.0	RT GUN AFT	8100	VERT	27	4.34
396.0	LT GUN FWD	8100	VERT	27	4.15
500.0	LT GUN FWD	8100	LONG	26	0.88
548.0	LT GUN FWD	8100	LONG	26	0.68
1860.0	BOTH GUNS FWD	8100	LAT	26	0.82

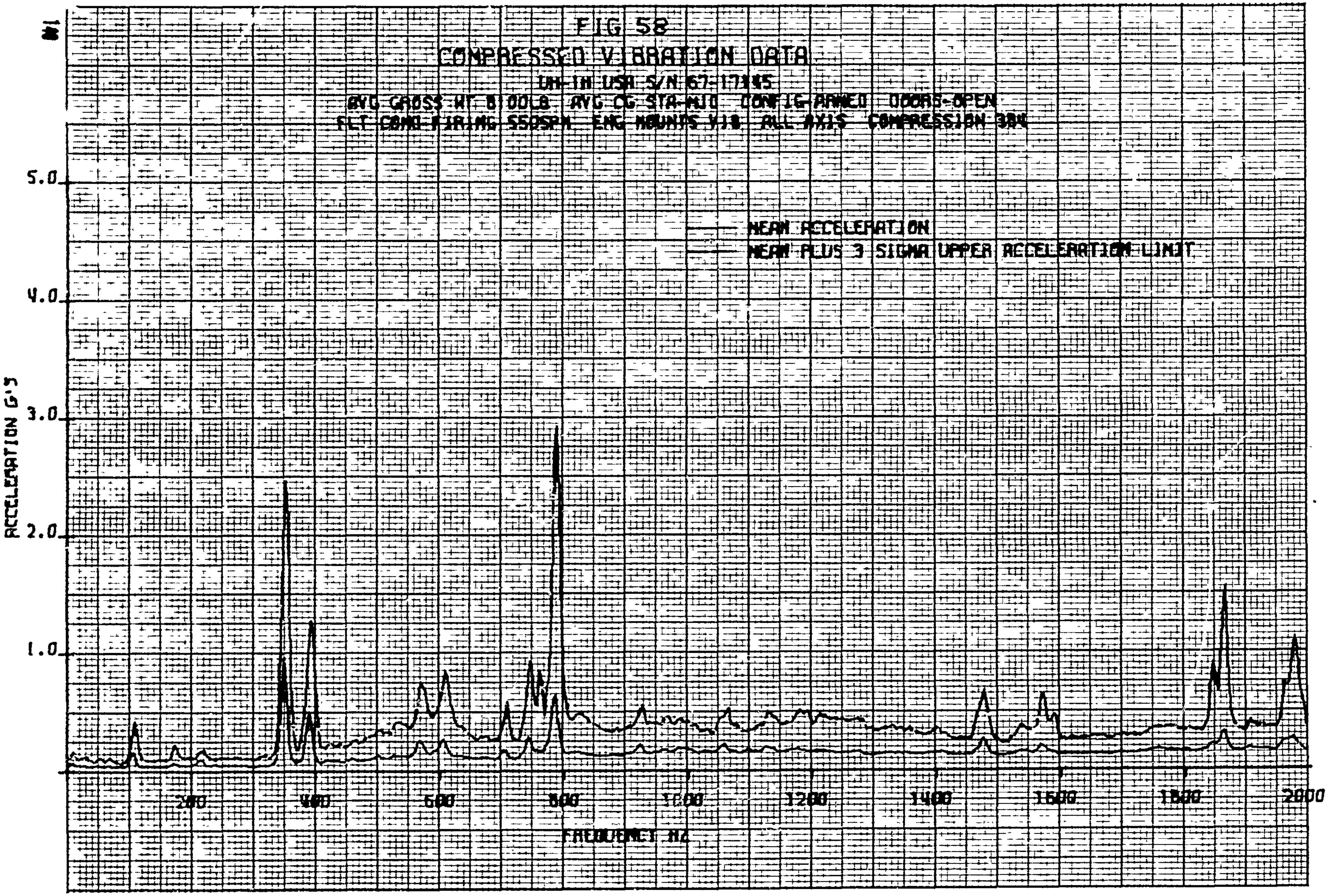


FIG 58
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN
FLT COND-FIRING 550SPM ENG NOUNPS V18 ALL AXIS COMPRESSION 30%
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
5.0
4.0
3.0
2.0
1.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

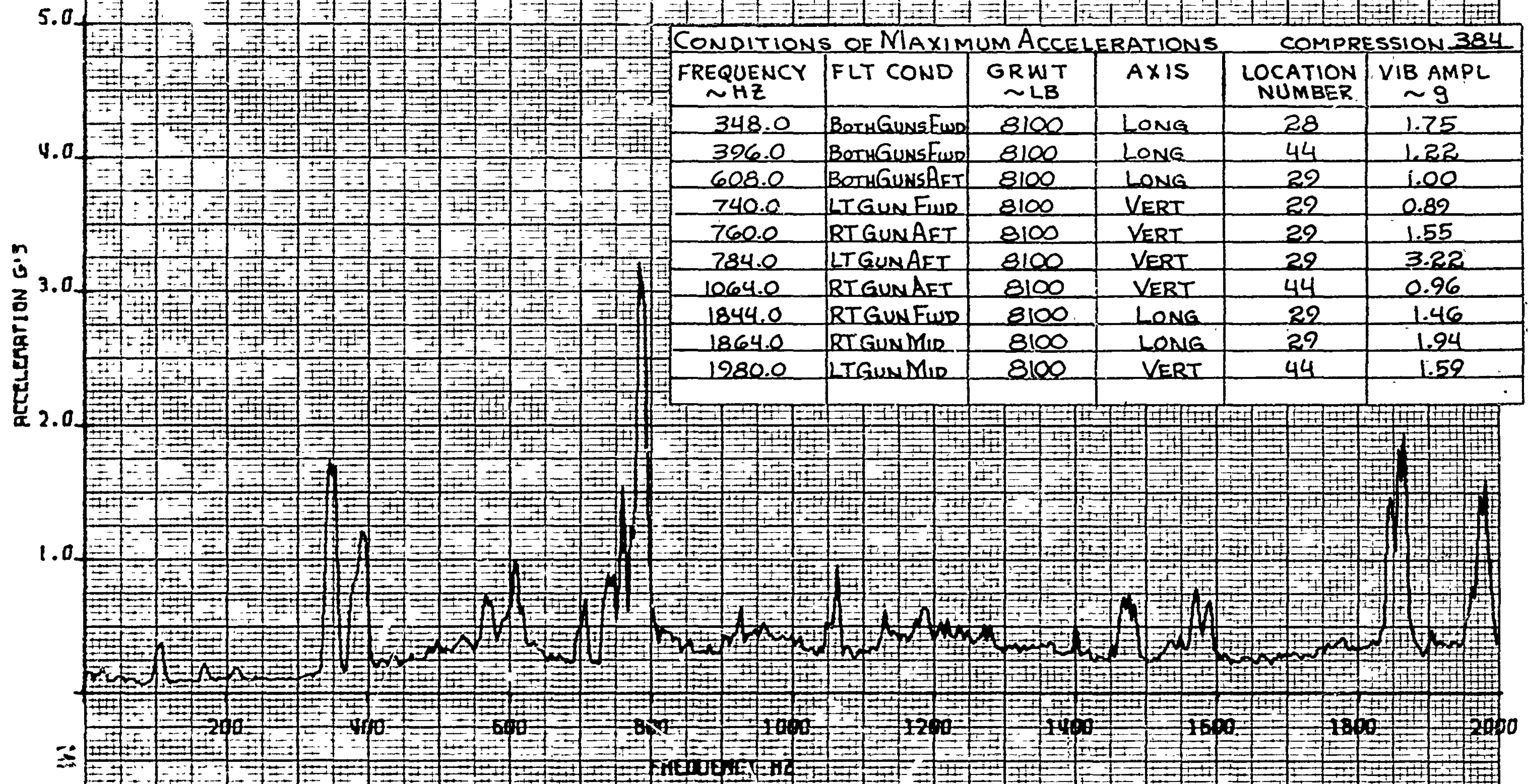
FIG 59

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN

FLT COND FIRING SEBSPA ENG MOUNTS VIB ALL AXIS COMPRESSION 384



CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 384

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
348.0	BOTH GUNS FWD	8100	LONG	28	1.75
396.0	BOTH GUNS FWD	8100	LONG	44	1.22
608.0	BOTH GUNS AFT	8100	LONG	29	1.00
740.0	LT GUN FWD	8100	VERT	29	0.89
760.0	RT GUN AFT	8100	VERT	29	1.55
784.0	LT GUN AFT	8100	VERT	29	3.22
1064.0	RT GUN AFT	8100	VERT	44	0.96
1844.0	RT GUN FWD	8100	LONG	29	1.46
1864.0	RT GUN MID	8100	LONG	29	1.94
1980.0	LT GUN MID	8100	VERT	44	1.59

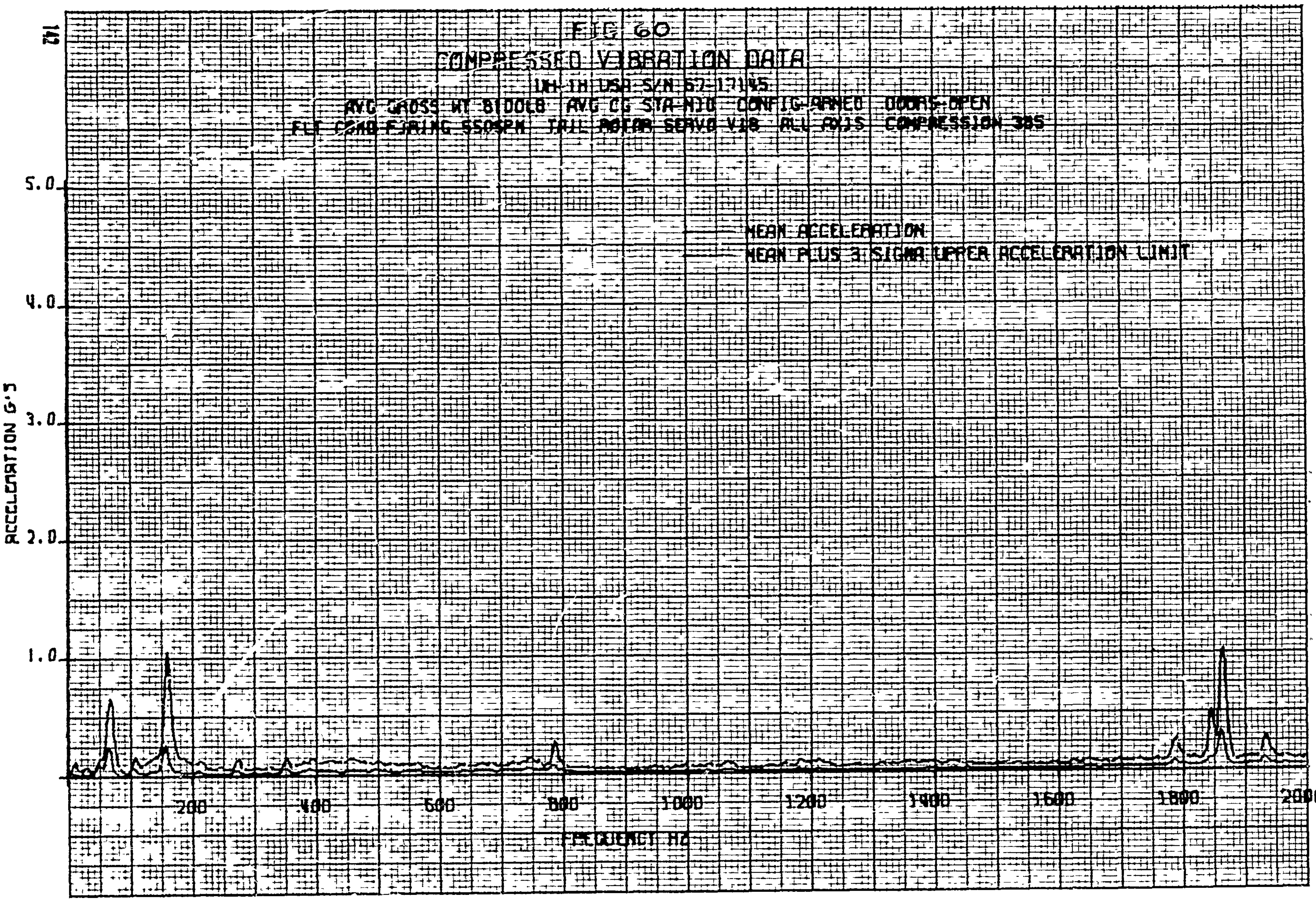


FIG 60
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-M10 CONFIG-ARMED DOORS-OPEN
FLT COND FIRING 550SPM TAIL ROTOR SERVO V18 ALL AXIS COMPRESSION 385
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
5.0
4.0
3.0
2.0
1.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

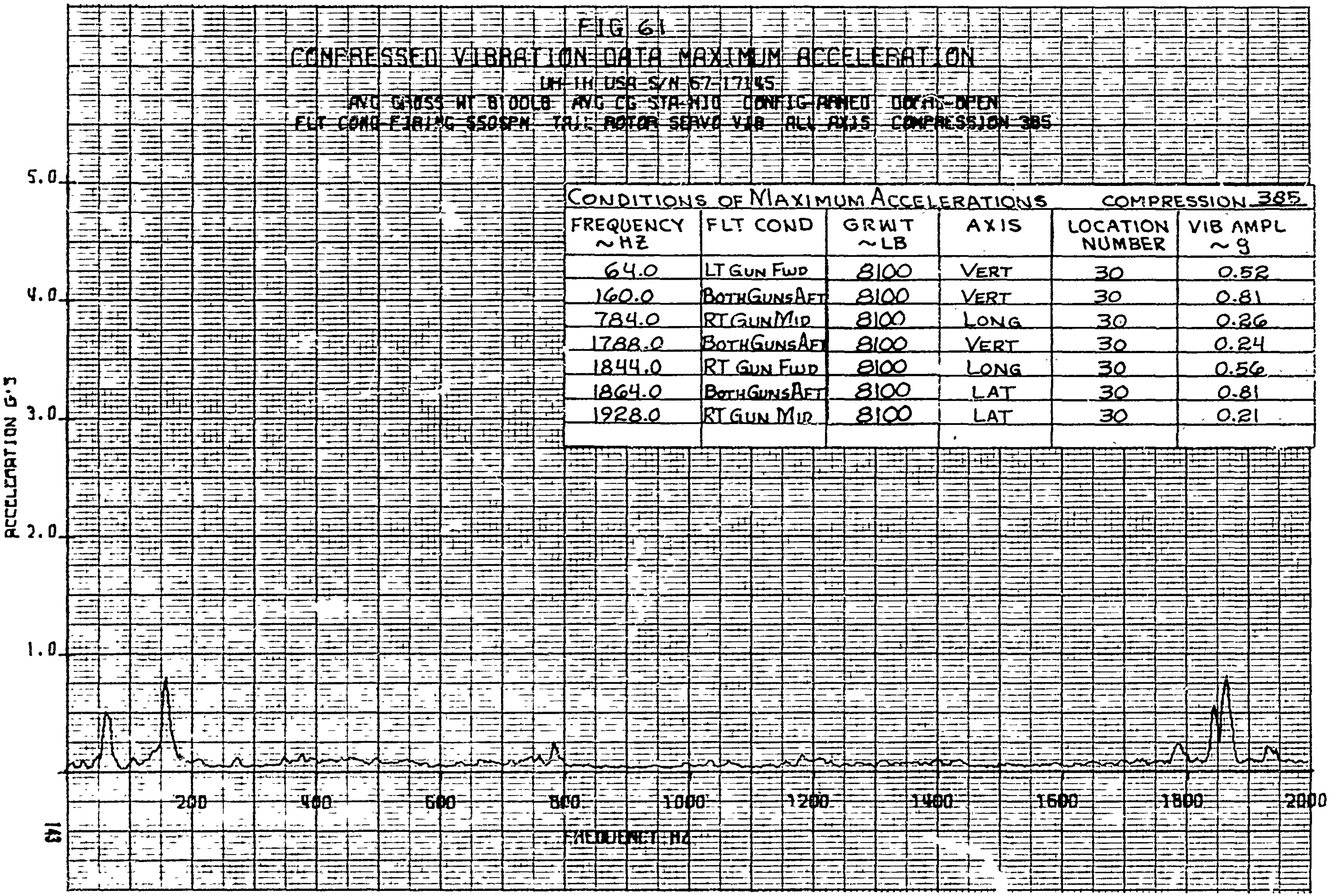
FIG 61

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA MID CONFIG ARMED DOORS OPEN

FLT COND FIRING 550SPM TAIL ROTOR SERVO VIB ALL AXIS COMPRESSION 385



CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 385

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
64.0	LT GUN FWD	8100	VERT	30	0.52
160.0	BOTH GUNS AFT	8100	VERT	30	0.81
784.0	RT GUN MID	8100	LONG	30	0.26
1788.0	BOTH GUNS AFT	8100	VERT	30	0.24
1844.0	RT GUN FWD	8100	LONG	30	0.56
1864.0	BOTH GUNS AFT	8100	LAT	30	0.81
1928.0	RT GUN MID	8100	LAT	30	0.21

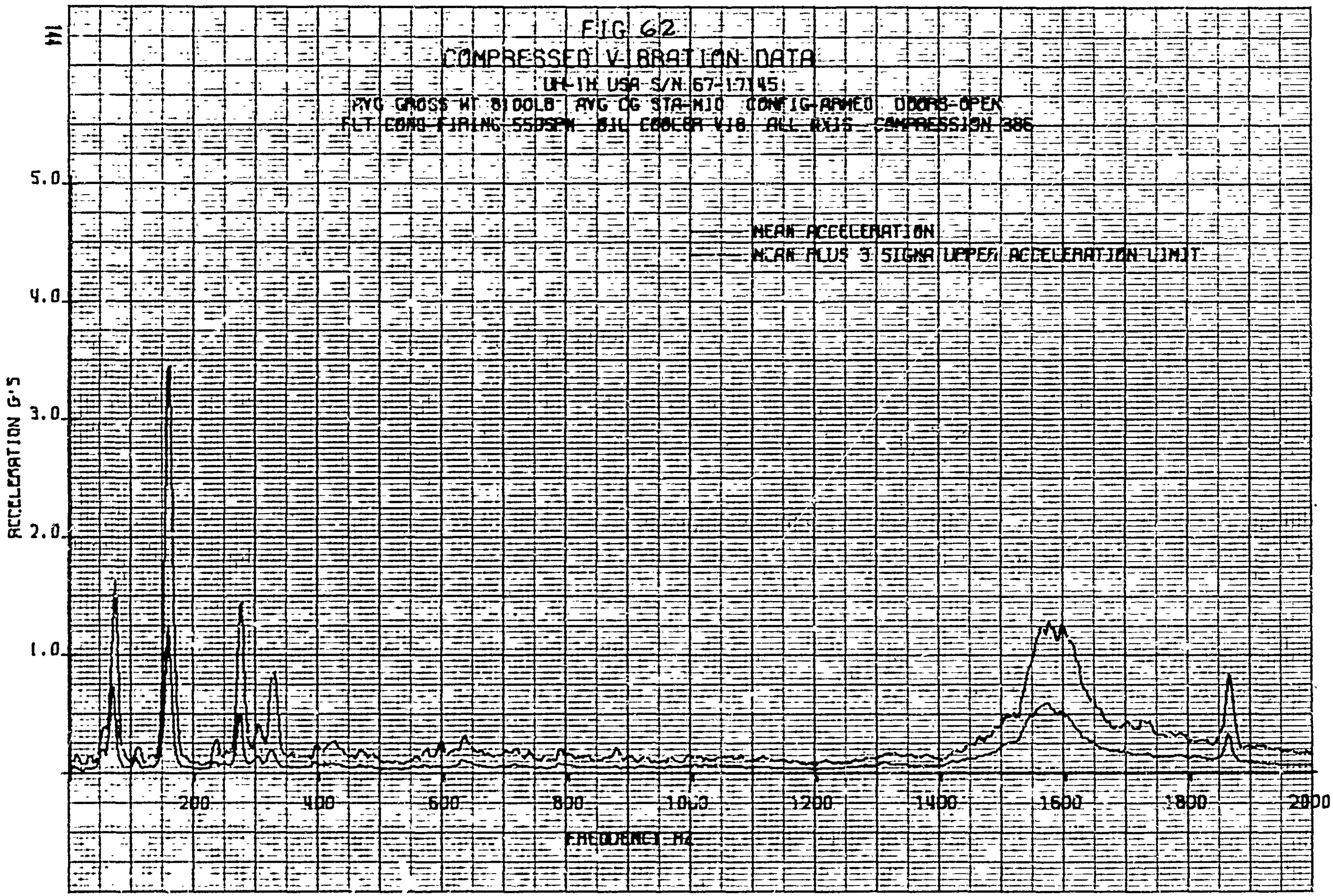


FIG 62
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-N10 CONFIG-ARMED DOORS-OPEN
FLT COND FIRING 550SPM OIL COOLER V18 ALL AXIS COMPRESSION 386

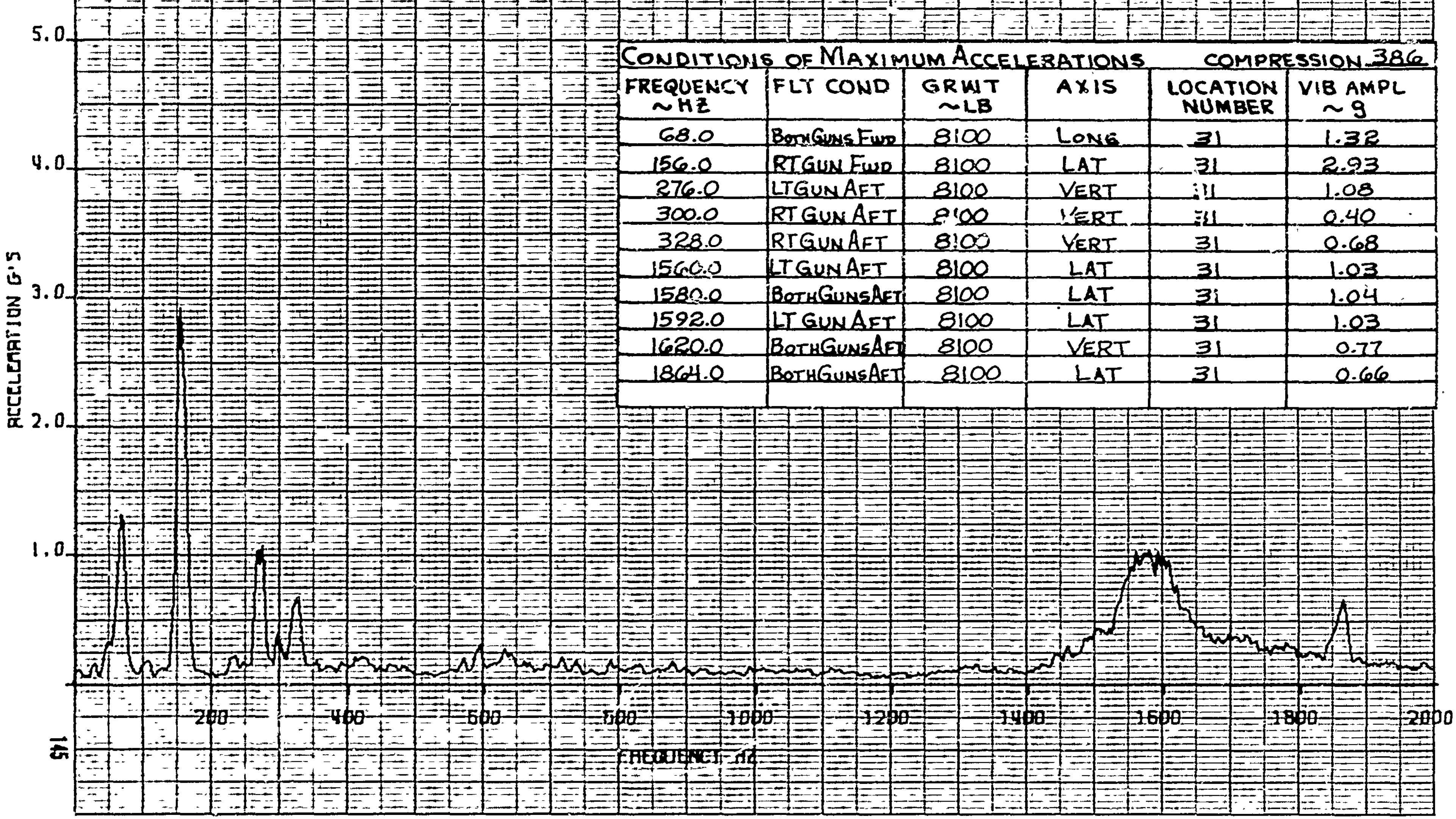
FIG 63

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN

FLT COND FIRING 5505PM OIL COOLER VIB ALL AXIS COMPRESSION 386



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 386

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
68.0	BOTH GUNS FWD	8100	LONG	31	1.32
156.0	RT GUN FWD	8100	LAT	31	2.93
276.0	LT GUN AFT	8100	VERT	31	1.08
300.0	RT GUN AFT	8100	VERT	31	0.40
328.0	RT GUN AFT	8100	VERT	31	0.68
1560.0	LT GUN AFT	8100	LAT	31	1.03
1580.0	BOTH GUNS AFT	8100	LAT	31	1.04
1592.0	LT GUN AFT	8100	LAT	31	1.03
1620.0	BOTH GUNS AFT	8100	VERT	31	0.77
1864.0	BOTH GUNS AFT	8100	LAT	31	0.66

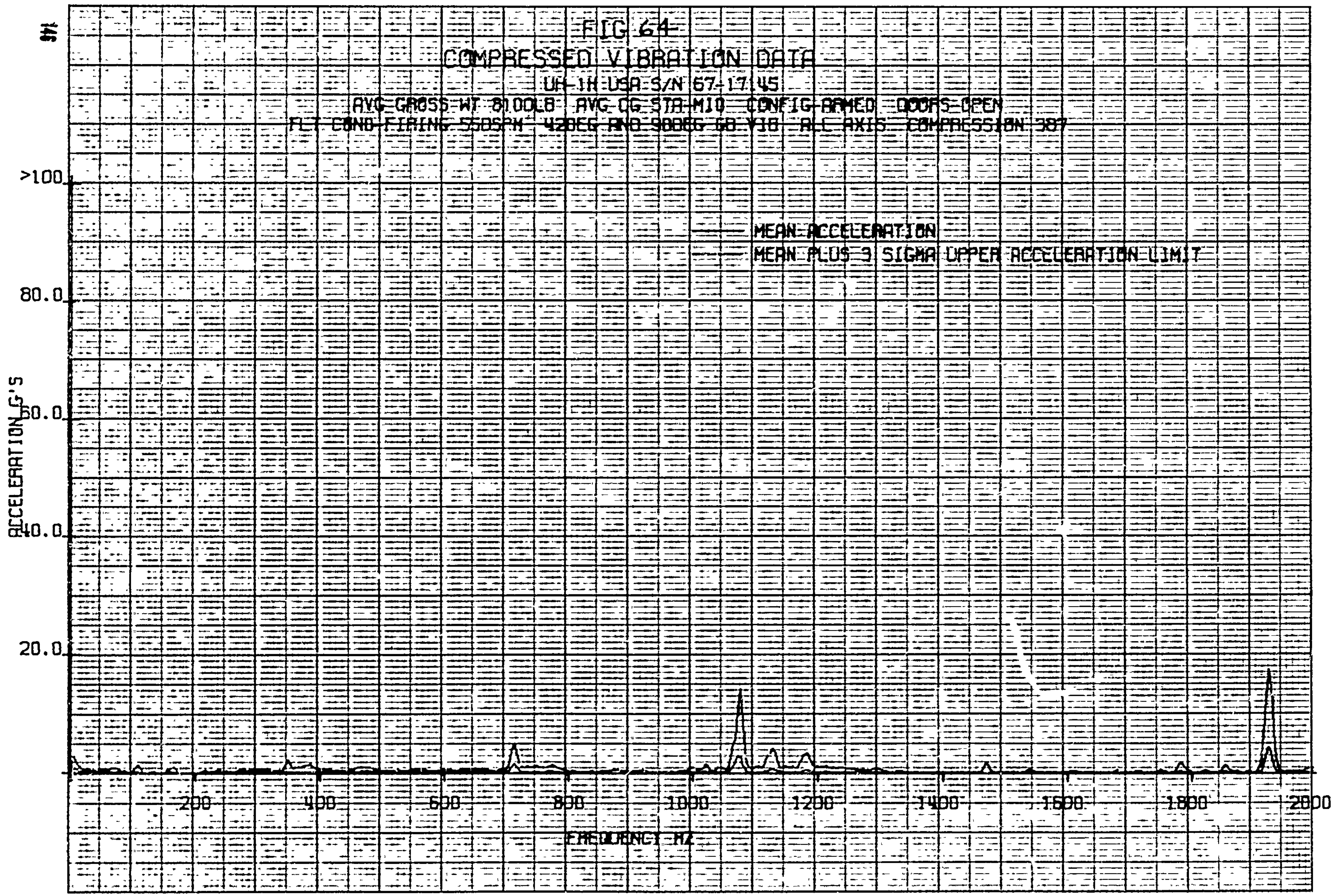


FIG 64
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA M10 CONFIG ARMED DOORS OPEN
FLT COND FIRING 550SPM 42DEG AND 90DEG GB Y10 ALL AXIS COMPRESSION 387
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
>100
80.0
60.0
40.0
20.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

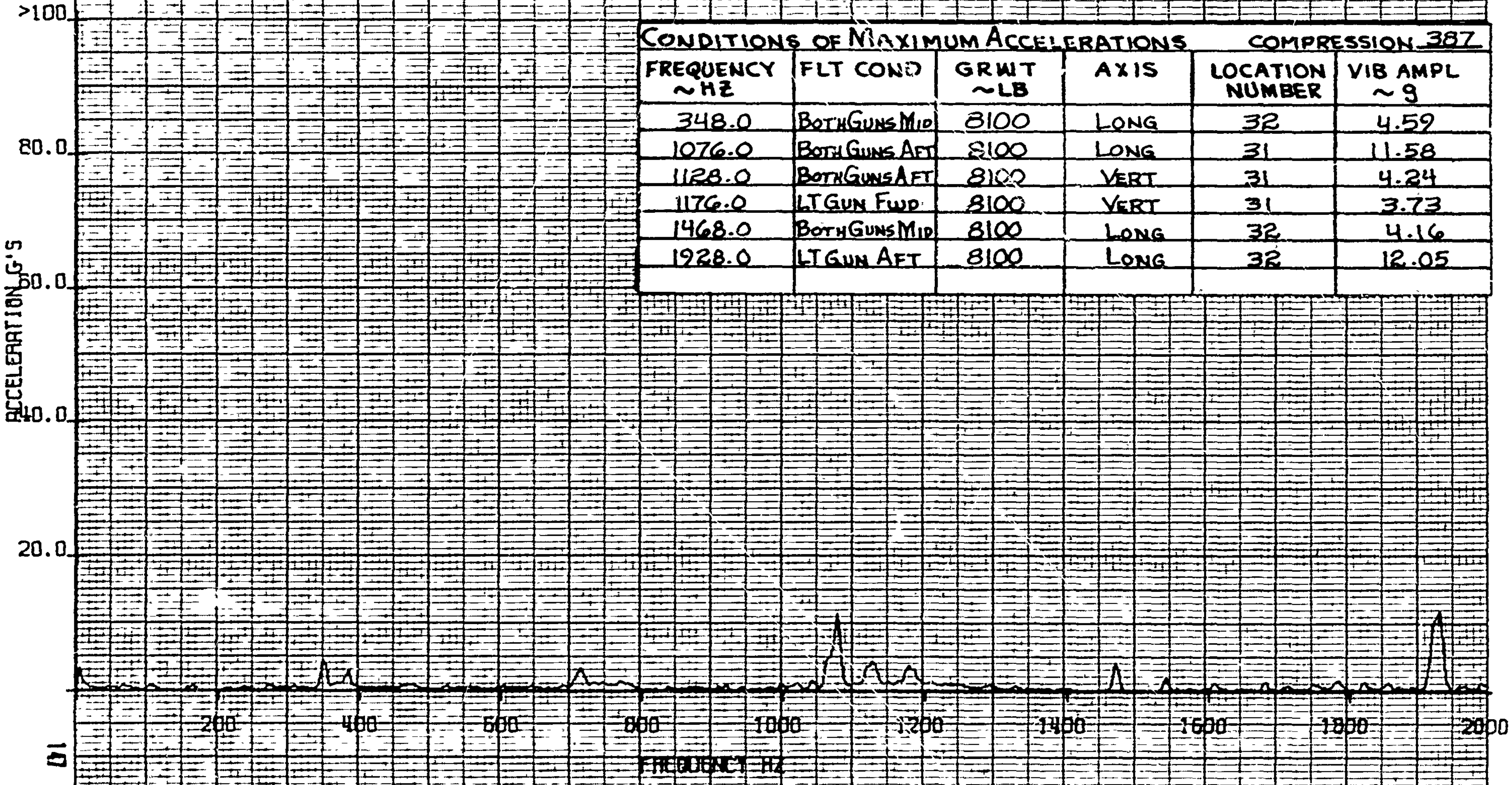
FIG 65

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

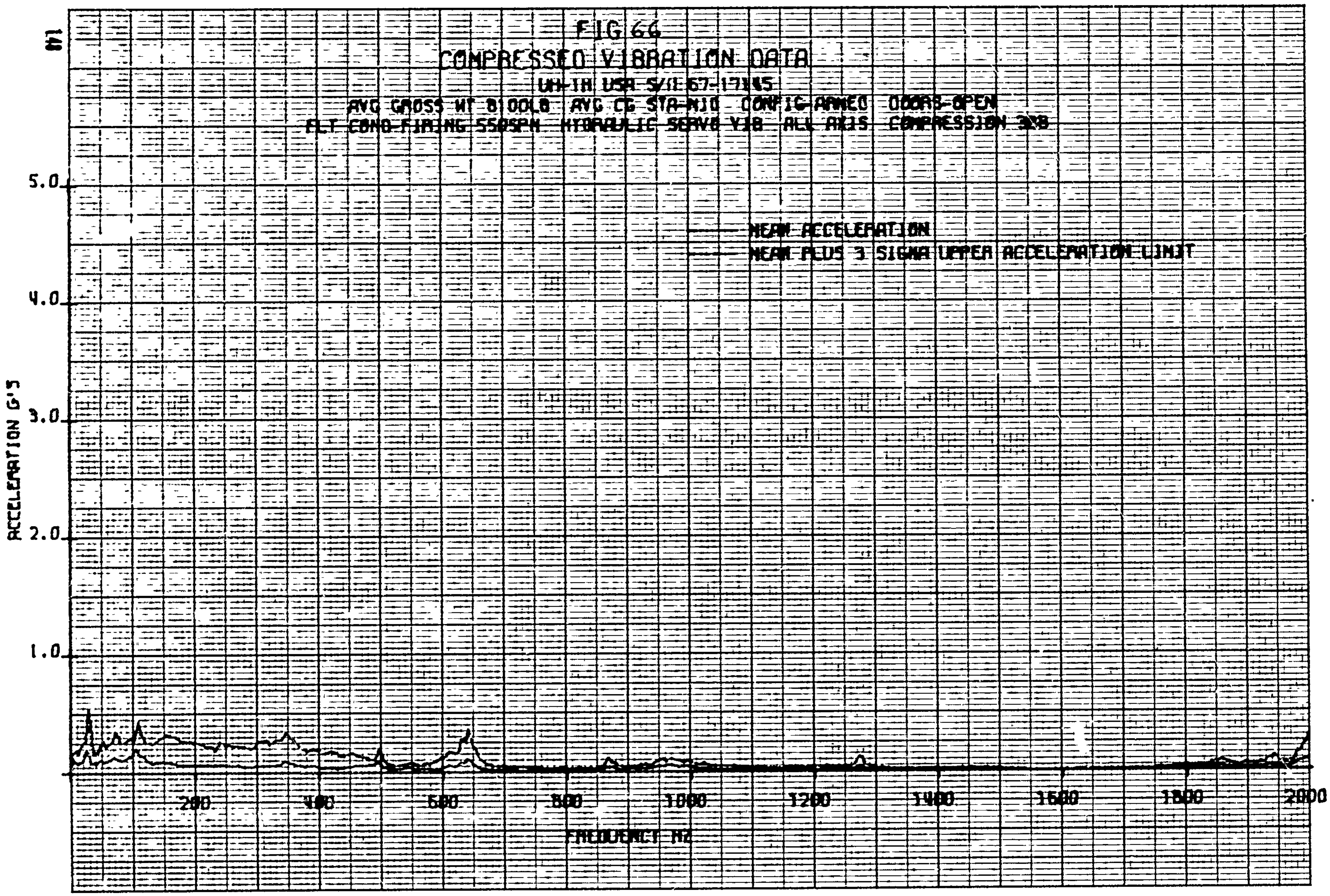
AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN

FLT COND-FIRING 550SPM 42DEG AND 90DEG SB VIB ALL AXIS COMPRESSION 387



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 387

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
348.0	BOTH GUNS MID	8100	LONG	32	4.59
1076.0	BOTH GUNS AFT	8100	LONG	31	11.58
1128.0	BOTH GUNS AFT	8100	VERT	31	4.24
1176.0	LT GUN FWD	8100	VERT	31	3.73
1468.0	BOTH GUNS MID	8100	LONG	32	4.16
1928.0	LT GUN AFT	8100	LONG	32	12.05



141
FIG 66
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-N10 CONFIG-ARMED DOORS-OPEN
FLT COND-FIRING 550SPM HYDRAULIC SERVO Y18 ALL AXIS COMPRESSION 32B
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
5.0
4.0
3.0
2.0
1.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

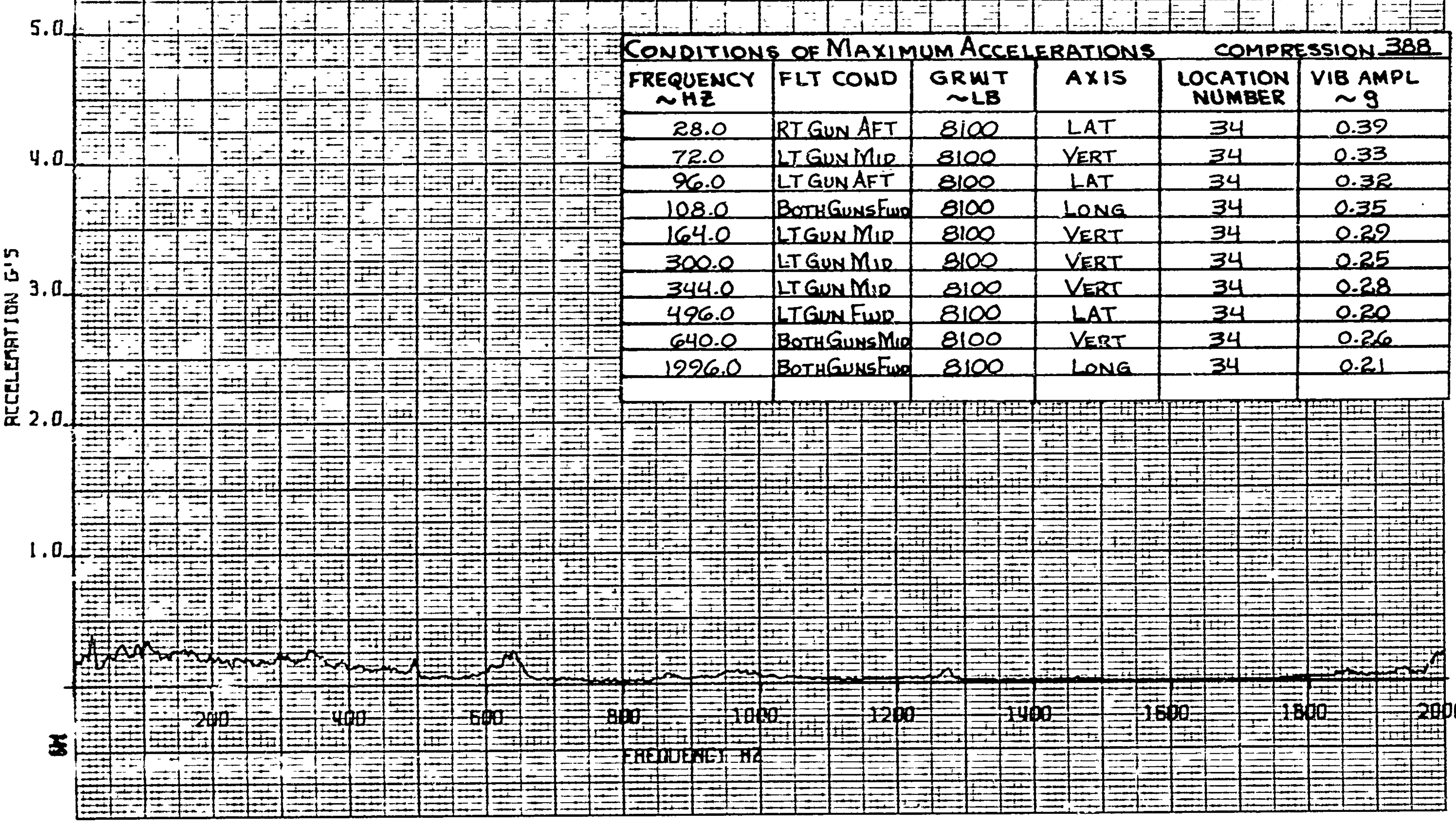
FIG 67

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN

FLT COND FIRING 550SPM HYDRAULIC SERVO VIB ALL AXIS COMPRESSION 388



CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 388

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
28.0	RT GUN AFT	8100	LAT	34	0.39
72.0	LT GUN MID	8100	VERT	34	0.33
96.0	LT GUN AFT	8100	LAT	34	0.32
108.0	BOTH GUNS FWD	8100	LONG	34	0.35
164.0	LT GUN MID	8100	VERT	34	0.29
300.0	LT GUN MID	8100	VERT	34	0.25
344.0	LT GUN MID	8100	VERT	34	0.28
496.0	LT GUN FWD	8100	LAT	34	0.20
640.0	BOTH GUNS MID	8100	VERT	34	0.26
1996.0	BOTH GUNS FWD	8100	LONG	34	0.21

149

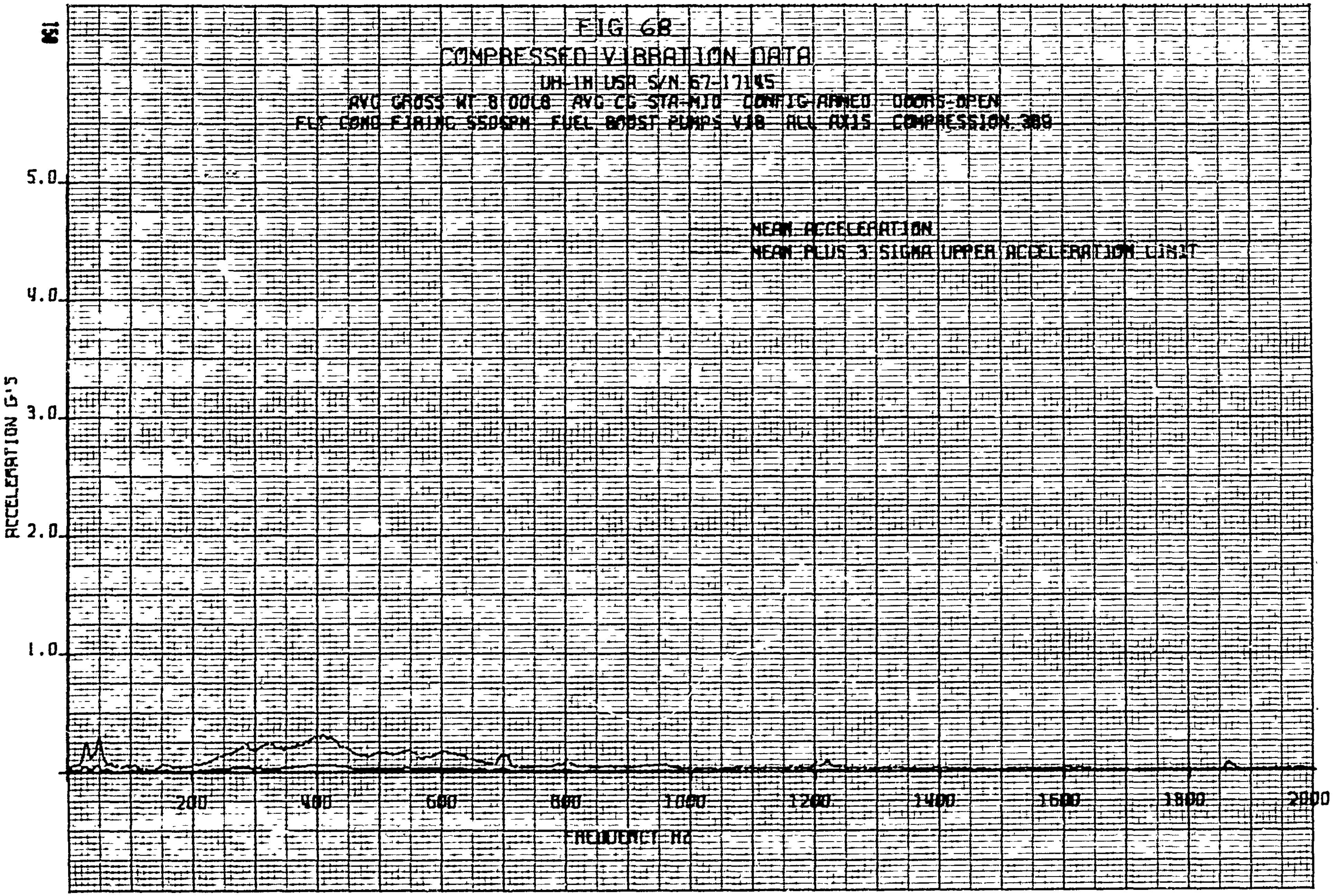


FIG 68
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8 00LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN
FLT COND FIRING 550SPM FUEL BOOST PUMPS V18 ALL AXIS COMPRESSION 300
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
5.0
4.0
3.0
2.0
1.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

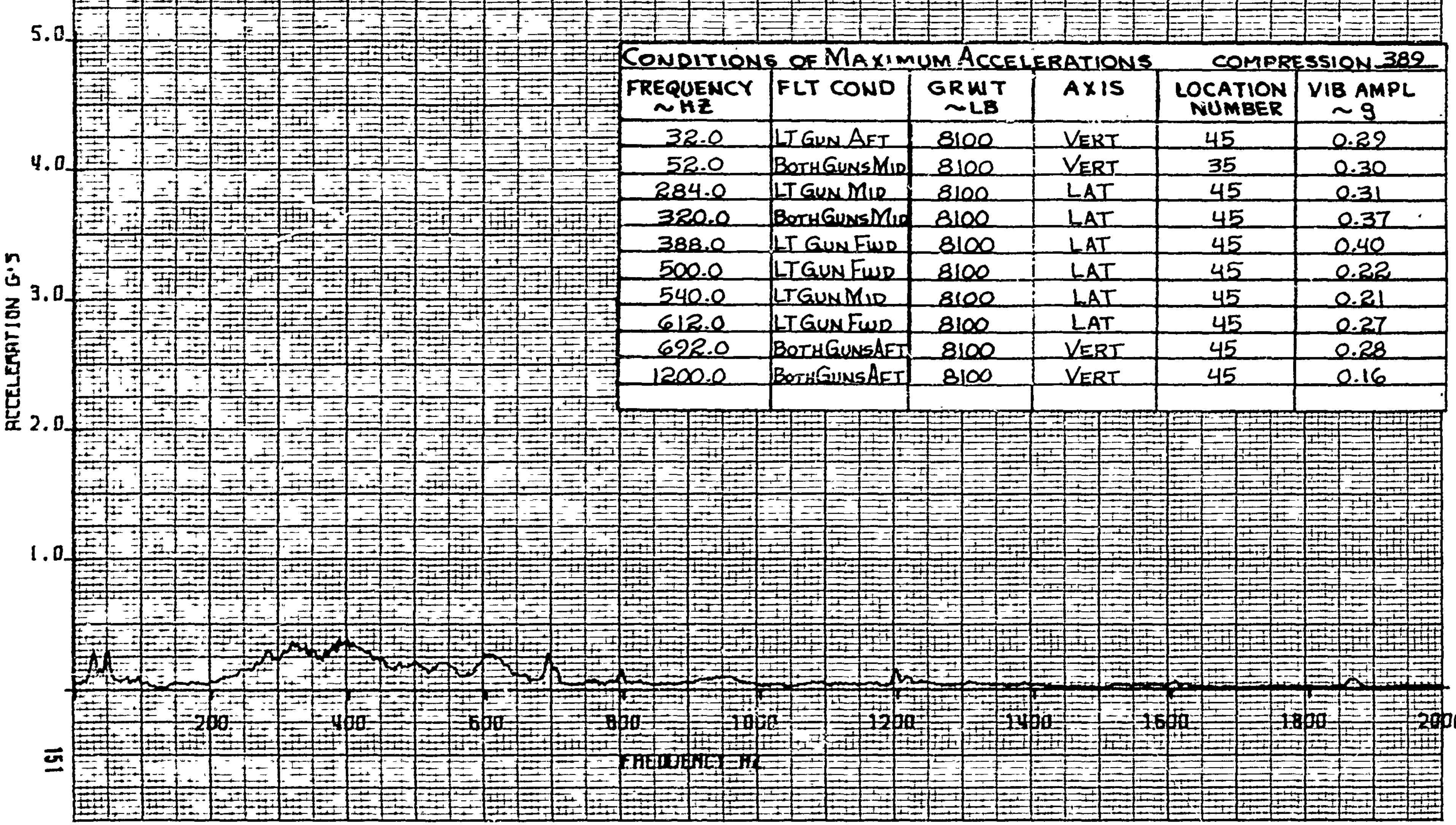
FIG 69

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1M USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN

FLT COND FIRING 550SPM FUEL BOOST PUMPS VIB ALL AXIS COMPRESSION 386



CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 389

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
32.0	LT GUN AFT	8100	VERT	45	0.29
52.0	BOTH GUNS MID	8100	VERT	35	0.30
284.0	LT GUN MID	8100	LAT	45	0.31
320.0	BOTH GUNS MID	8100	LAT	45	0.37
388.0	LT GUN FWD	8100	LAT	45	0.40
500.0	LT GUN FWD	8100	LAT	45	0.22
540.0	LT GUN MID	8100	LAT	45	0.21
612.0	LT GUN FWD	8100	LAT	45	0.27
692.0	BOTH GUNS AFT	8100	VERT	45	0.28
1200.0	BOTH GUNS AFT	8100	VERT	45	0.16

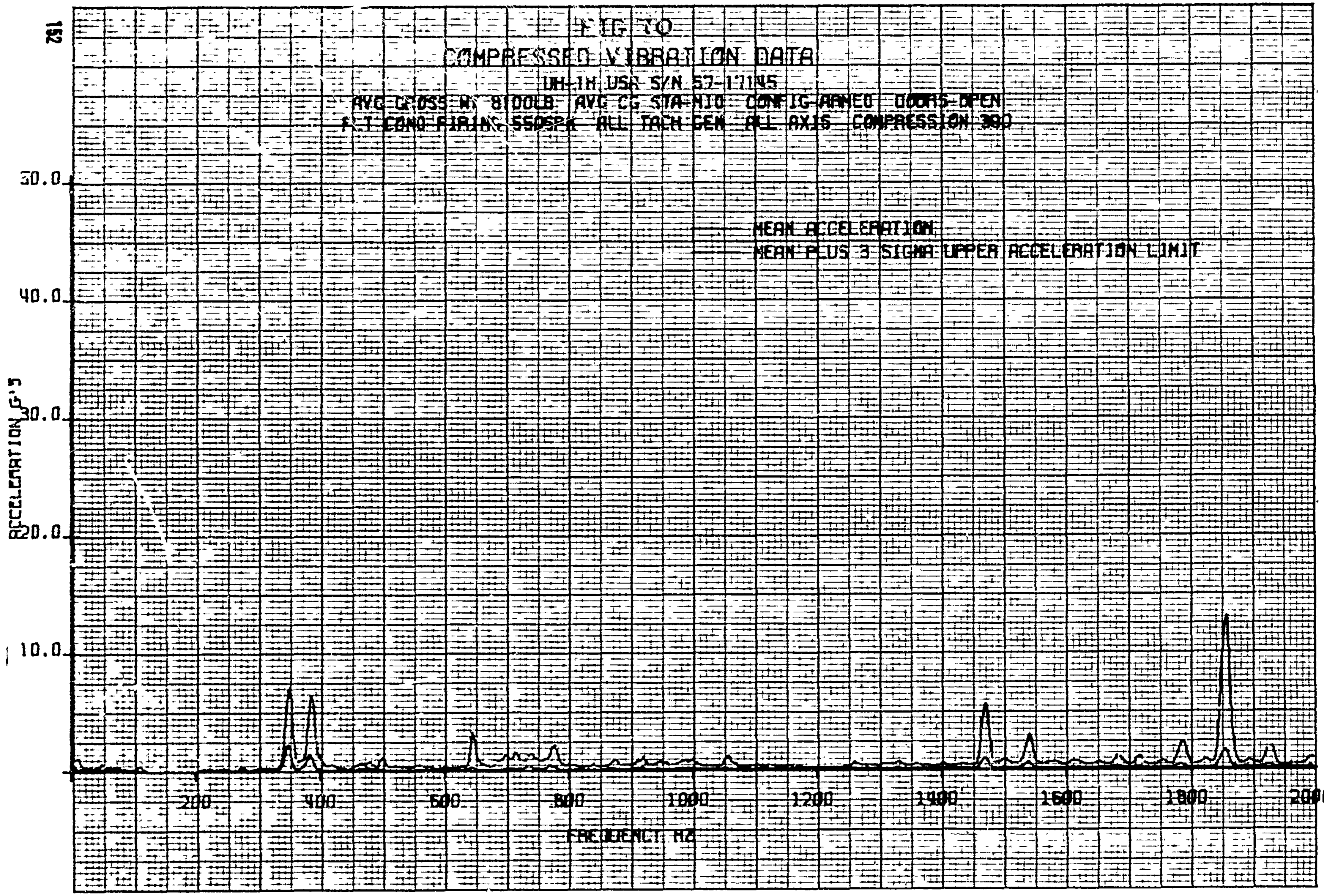


FIG 70
COMPRESSED VIBRATION DATA
UH-1H USA S/N 57-17145
AVG GROSS WT 8100LB AVG CG STA-N10 CONFIG-ARMED DOORS-OPEN
FLT COND FIRING 550SPM ALL TACH GEN ALL AXIS COMPRESSION 300
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
50.0
40.0
30.0
20.0
10.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

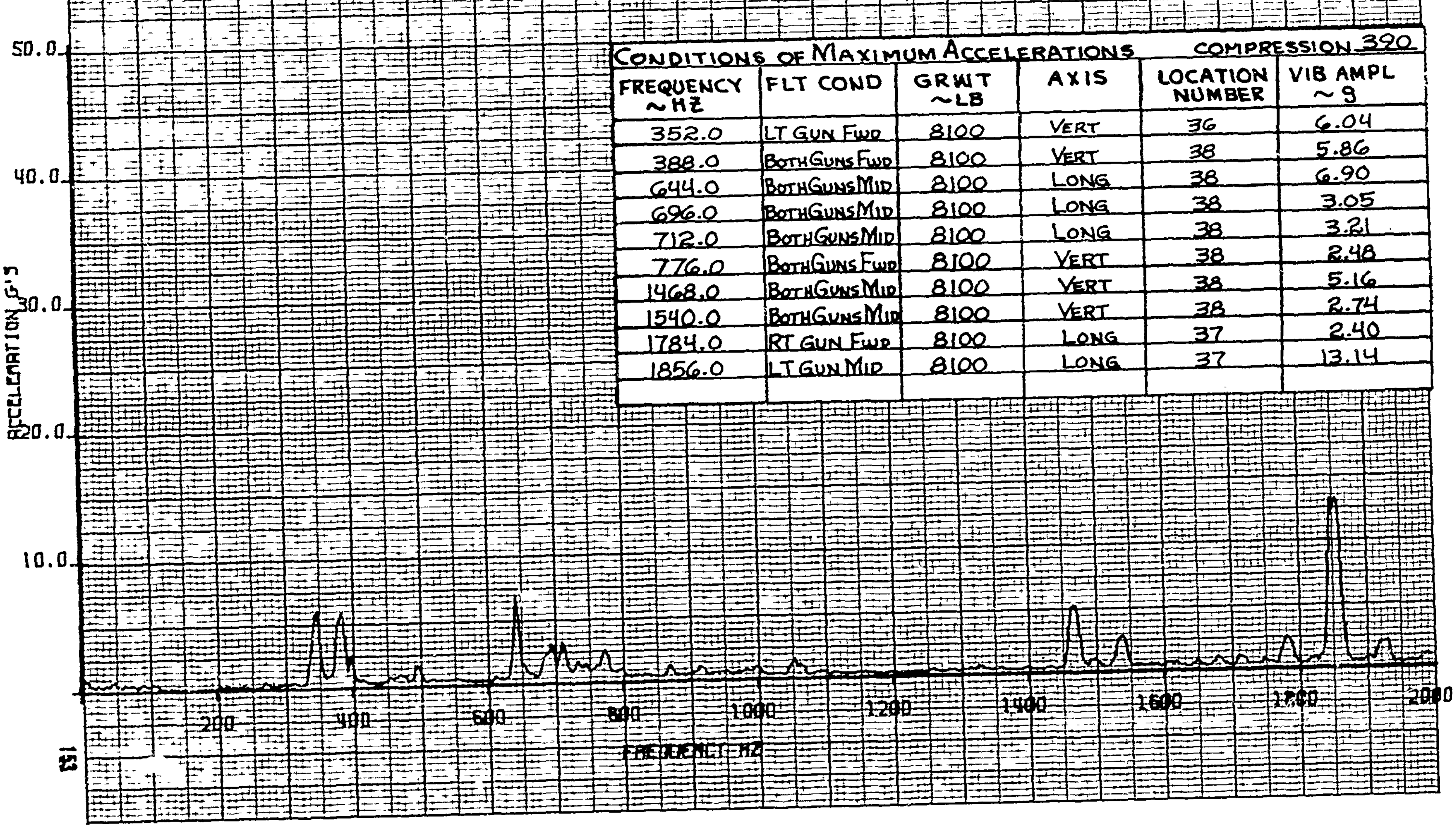
FIG 71

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-N10 CONFIG-ARMED DOORS OPEN

FLT COND FIRING 550SPM ALL TACH GEN ALL AXIS COMPRESSION 390



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 390

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
352.0	LT GUN FWD	8100	VERT	36	6.04
388.0	BOTH GUNS FWD	8100	VERT	38	5.86
644.0	BOTH GUNS MID	8100	LONG	38	6.90
696.0	BOTH GUNS MID	8100	LONG	38	3.05
712.0	BOTH GUNS MID	8100	LONG	38	3.21
776.0	BOTH GUNS FWD	8100	VERT	38	2.48
1468.0	BOTH GUNS MID	8100	VERT	38	5.16
1540.0	BOTH GUNS MID	8100	VERT	38	2.74
1784.0	RT GUN FWD	8100	LONG	37	2.40
1856.0	LT GUN MID	8100	LONG	37	13.14

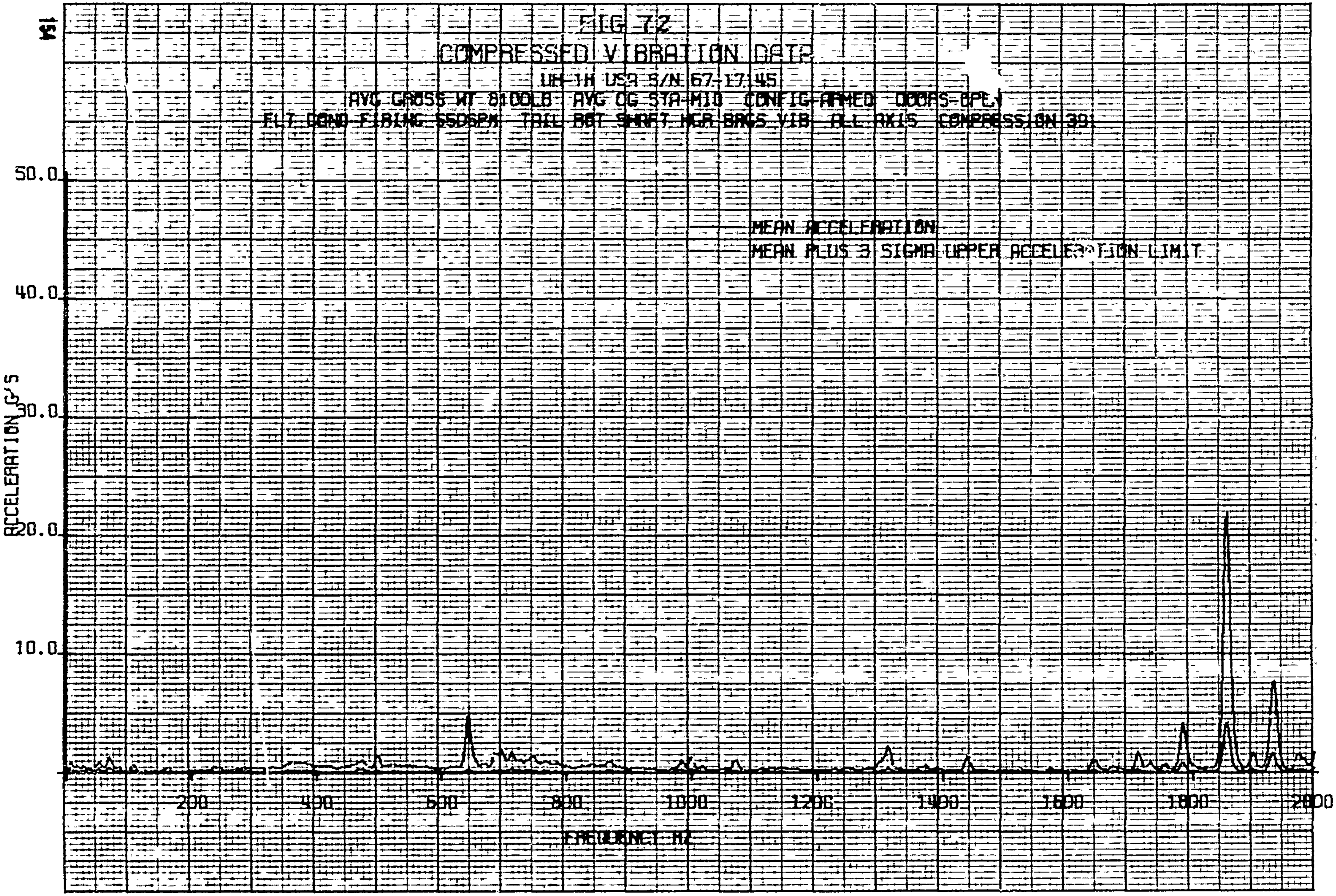


FIG 72
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN
FLT COND FIRING SSDSPM TAIL ROT SHAFT HGR BRGS VIB ALL AXIS COMPRESSION 39:
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G/S
50.0
40.0
30.0
20.0
10.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

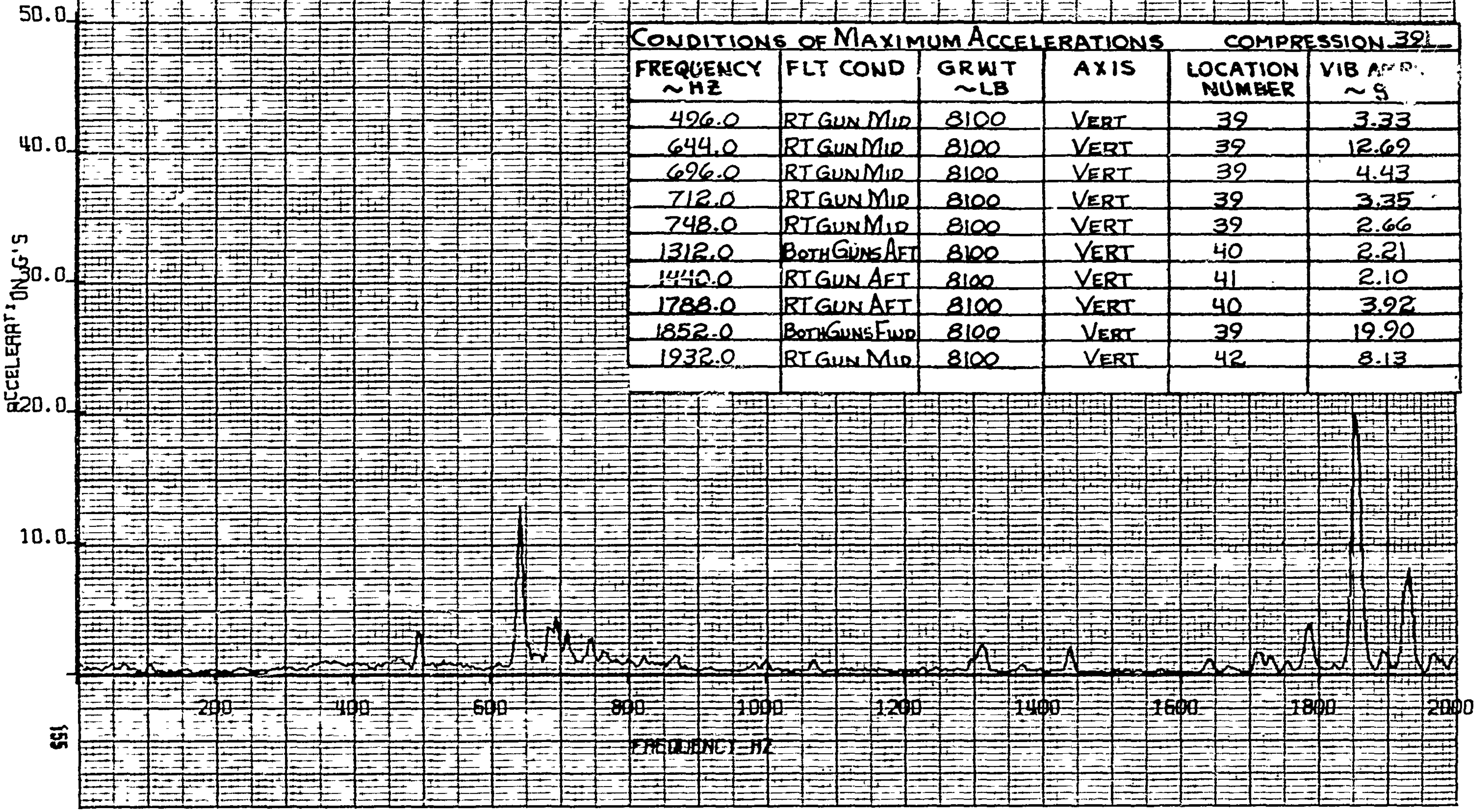
FIG 73

COMPRESSED VIBRATION DATA-MAXIMUM ACCELERATION

UH-1H USA S/N 57-17145

AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN

FLT COND FIRING 550SPM TAIL ROT SHAFT HGR BRGS VIB ALL AXIS COMPRESSION 391



CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 391

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMP. ~g
496.0	RT GUN MID	8100	VERT	39	3.33
644.0	RT GUN MID	8100	VERT	39	12.69
696.0	RT GUN MID	8100	VERT	39	4.43
712.0	RT GUN MID	8100	VERT	39	3.35
748.0	RT GUN MID	8100	VERT	39	2.66
1312.0	BOTH GUNS AFT	8100	VERT	40	2.21
1440.0	RT GUN AFT	8100	VERT	41	2.10
1788.0	RT GUN AFT	8100	VERT	40	3.92
1852.0	BOTH GUNS FWD	8100	VERT	39	19.90
1932.0	RT GUN MID	8100	VERT	42	8.13

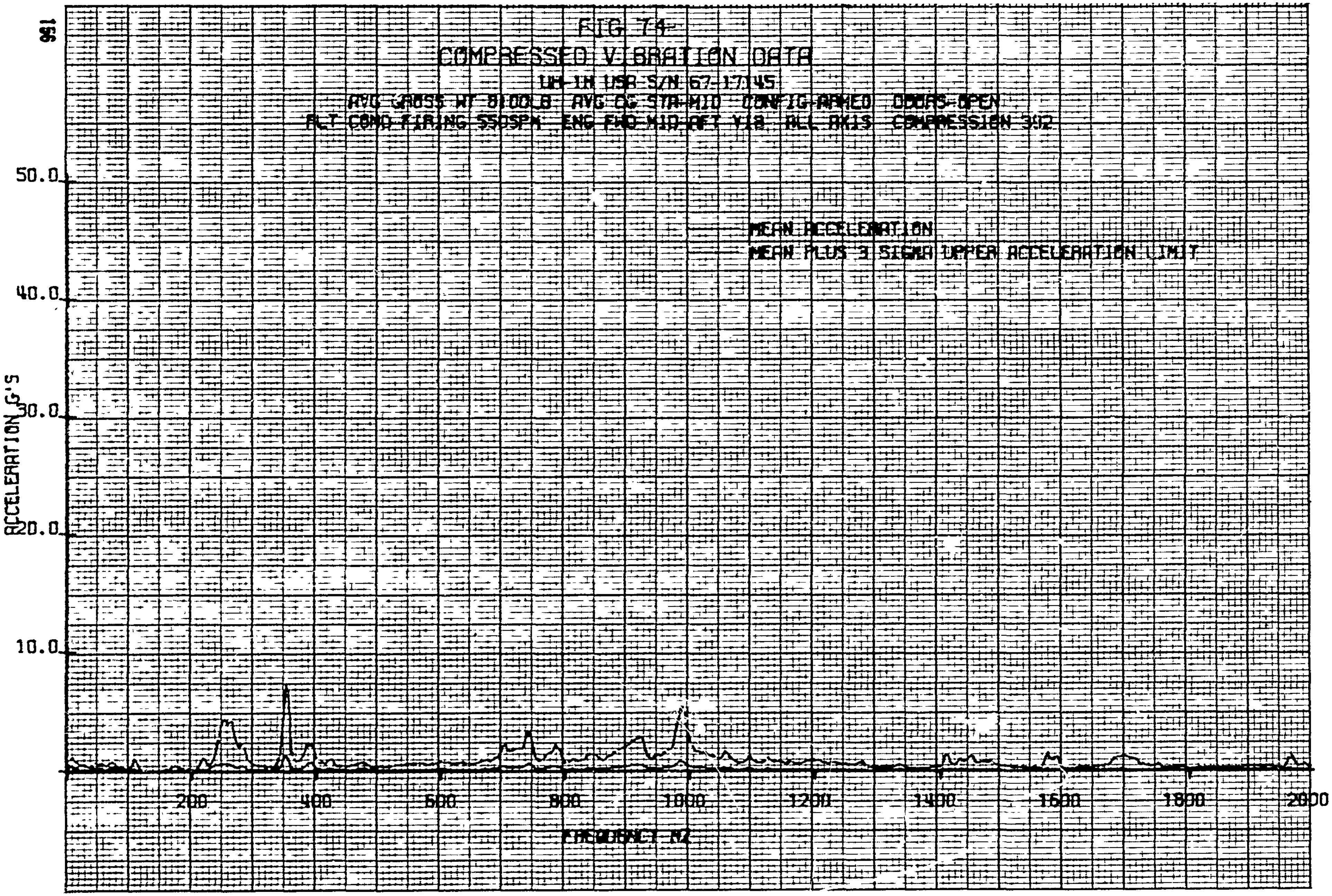


FIG 74
COMPRESSED VIBRATION DATA

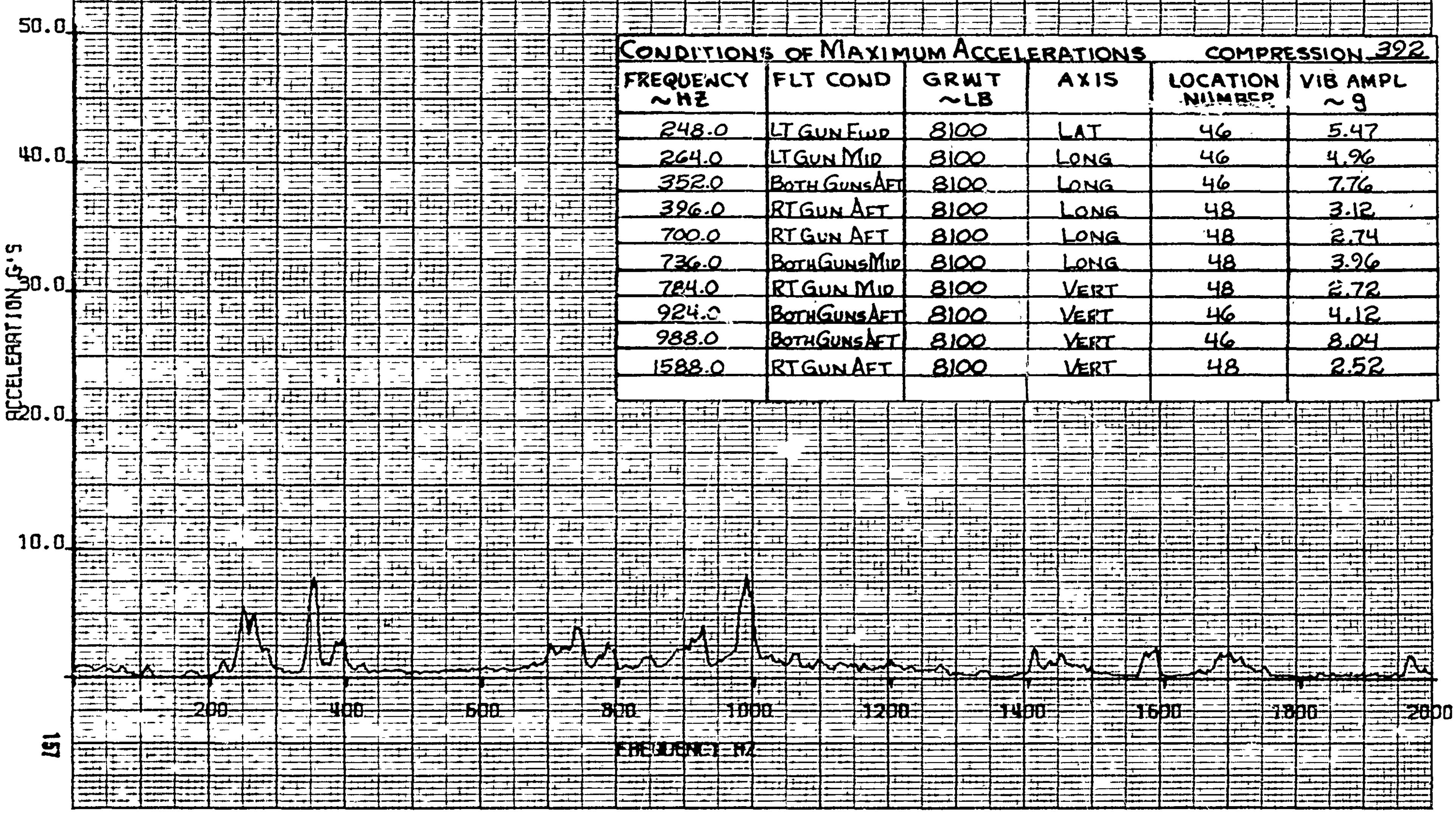
FIG 75

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1M USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN

FLT COND FIRING 550SPM ENG FWD-MID-AFT VIB ALL AXIS COMPRESSION 392



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 392

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
248.0	LT GUN FWD	8100	LAT	46	5.47
264.0	LT GUN MID	8100	LONG	46	4.96
352.0	BOTH GUNS AFT	8100	LONG	46	7.76
396.0	RT GUN AFT	8100	LONG	48	3.12
700.0	RT GUN AFT	8100	LONG	48	2.74
736.0	BOTH GUNS MID	8100	LONG	48	3.96
784.0	RT GUN MID	8100	VERT	48	2.72
924.0	BOTH GUNS AFT	8100	VERT	46	4.12
988.0	BOTH GUNS AFT	8100	VERT	46	8.04
1588.0	RT GUN AFT	8100	VERT	48	2.52

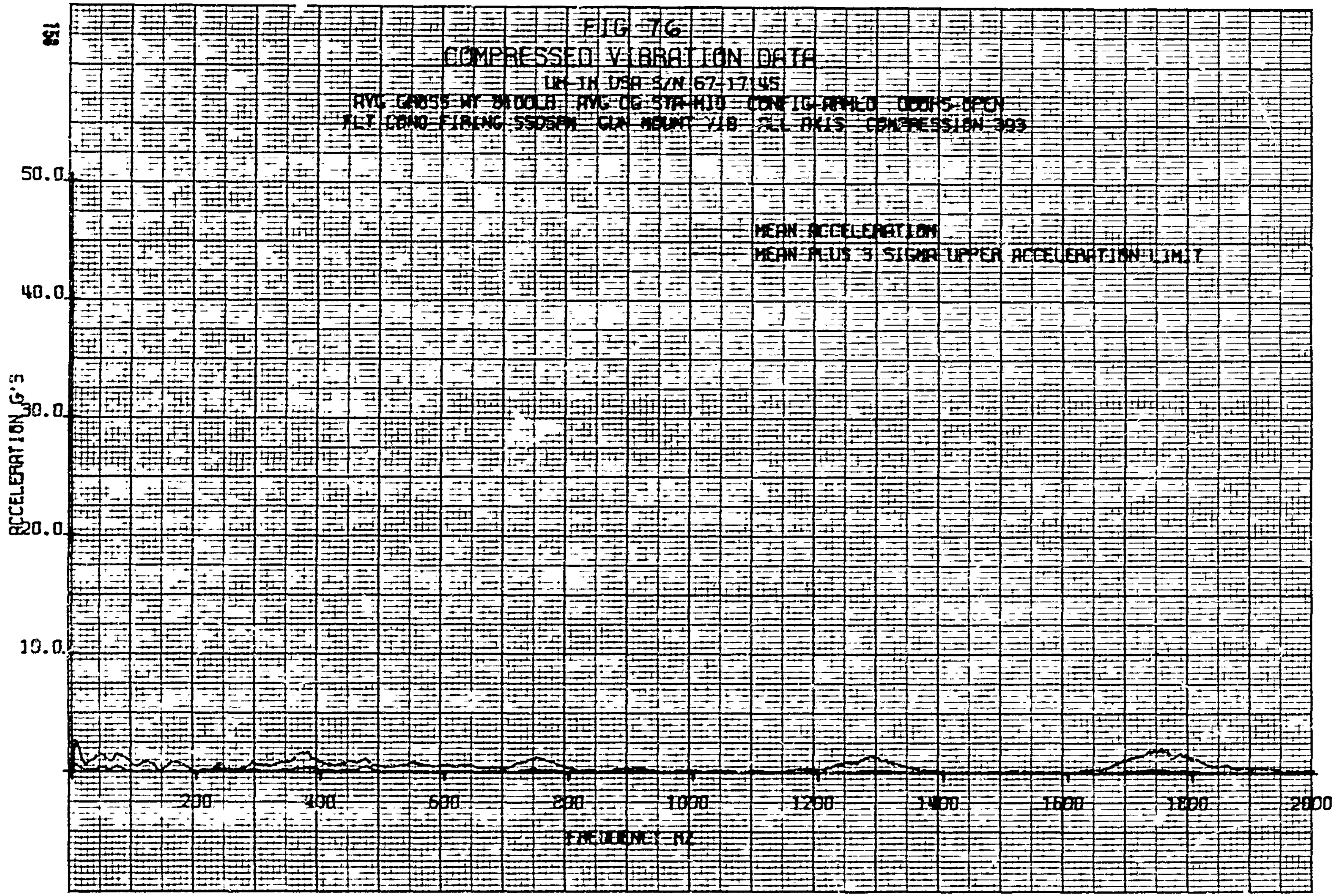


FIG 76
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8400LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN
FLT COND-FIRING SSDSPN GUN MOUNT VIB ALL AXIS COMPRESSION 393
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
50.0
40.0
30.0
20.0
10.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

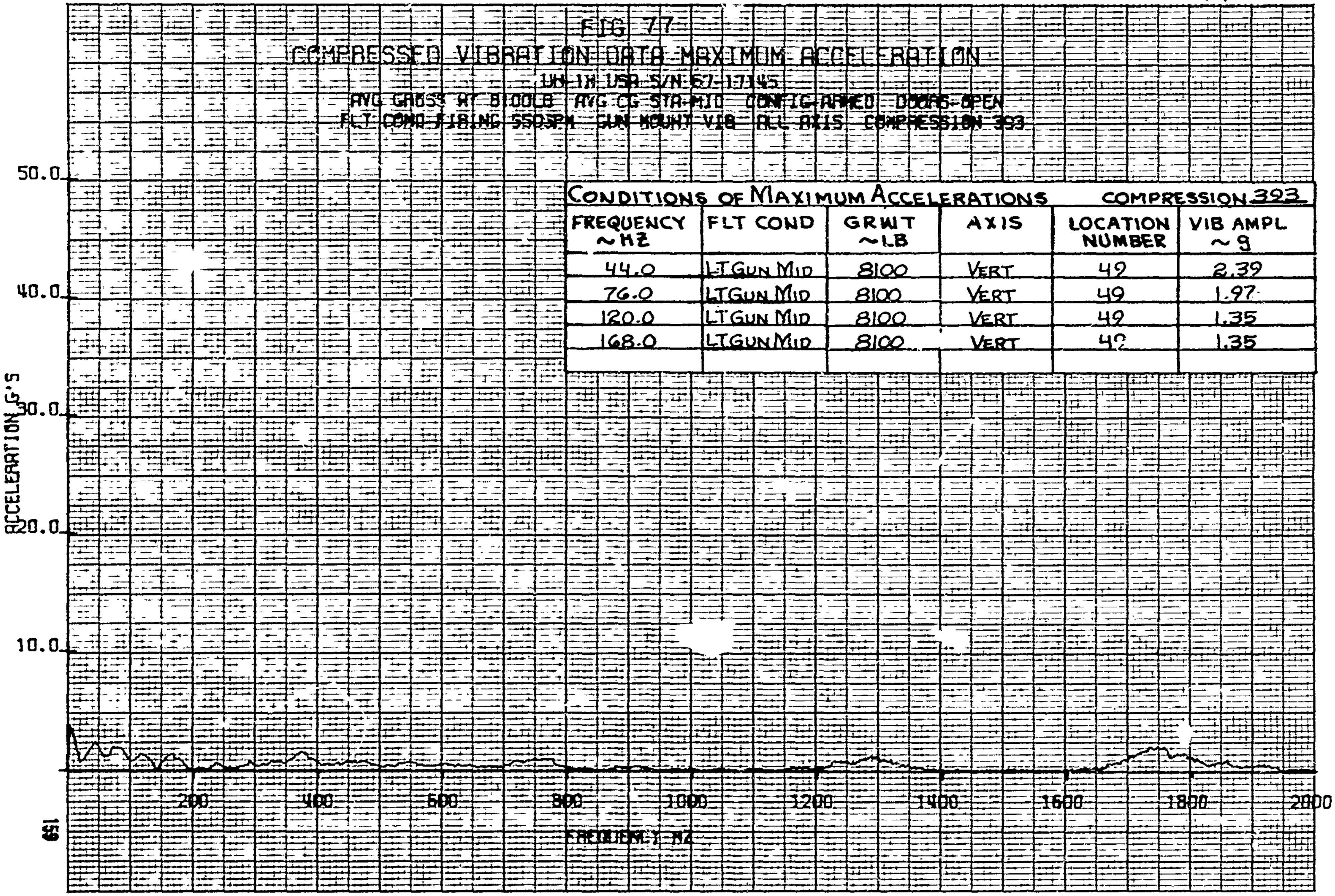
FIG 77

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN

FLT COND FIRING 550SPM GUN MOUNT VIB ALL AXIS COMPRESSION 393



CONDITIONS OF MAXIMUM ACCELERATIONS COMPRESSION 393

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
44.0	LTGUN MID	8100	VERT	49	2.39
76.0	LTGUN MID	8100	VERT	49	1.97
120.0	LTGUN MID	8100	VERT	49	1.35
168.0	LTGUN MID	8100	VERT	49	1.35

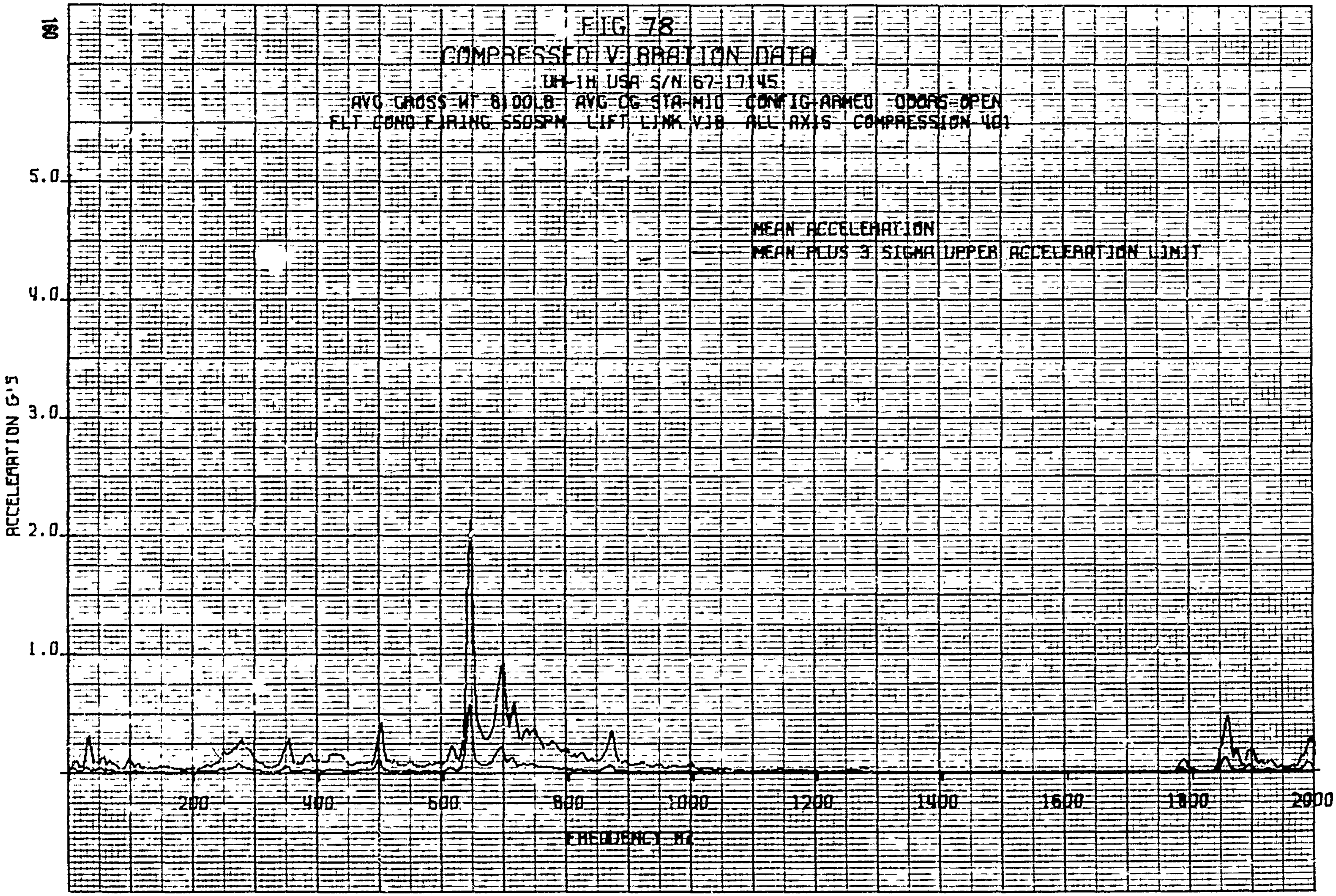


FIG 78
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 8100LB AVG CG STA-M10 CONFIG-ARMED DOORS-OPEN
FLT COND FIRING 550SPM LIFT LINK VIB ALL AXIS COMPRESSION 401
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
5.0
4.0
3.0
2.0
1.0
200
400
600
800
1000
1200
1400
1600
1800
2000
FREQUENCY HZ

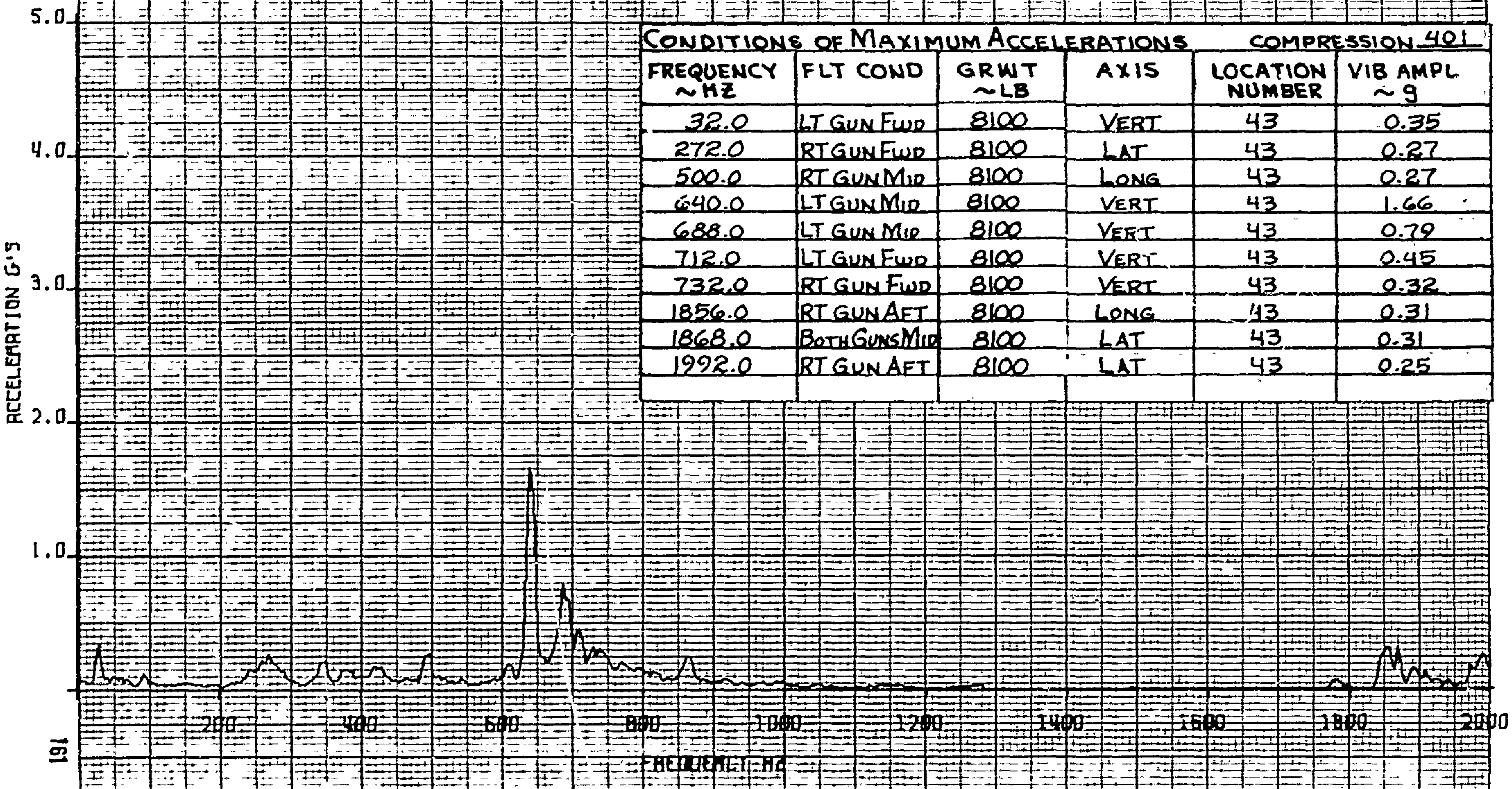
FIG 79

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

AVG GROSS WT 8100LB AVG CG STA-MID CONFIG-ARMED DOORS-OPEN

FLT COND FIRING SSGSPN LIFT LINK VIB ALL AXIS COMPRESSION 401



CONDITIONS OF MAXIMUM ACCELERATIONS — COMPRESSION 401

FREQUENCY ~HZ	FLT COND	GRWT ~LB	AXIS	LOCATION NUMBER	VIB AMPL ~g
32.0	LT GUN FWD	8100	VERT	43	0.35
272.0	RT GUN FWD	8100	LAT	43	0.27
500.0	RT GUN MID	8100	LONG	43	0.27
640.0	LT GUN MID	8100	VERT	43	1.66
688.0	LT GUN MID	8100	VERT	43	0.79
712.0	LT GUN FWD	8100	VERT	43	0.45
732.0	RT GUN FWD	8100	VERT	43	0.32
1856.0	RT GUN AFT	8100	LONG	43	0.31
1868.0	BOTH GUNS MID	8100	LAT	43	0.31
1992.0	RT GUN AFT	8100	LAT	43	0.25

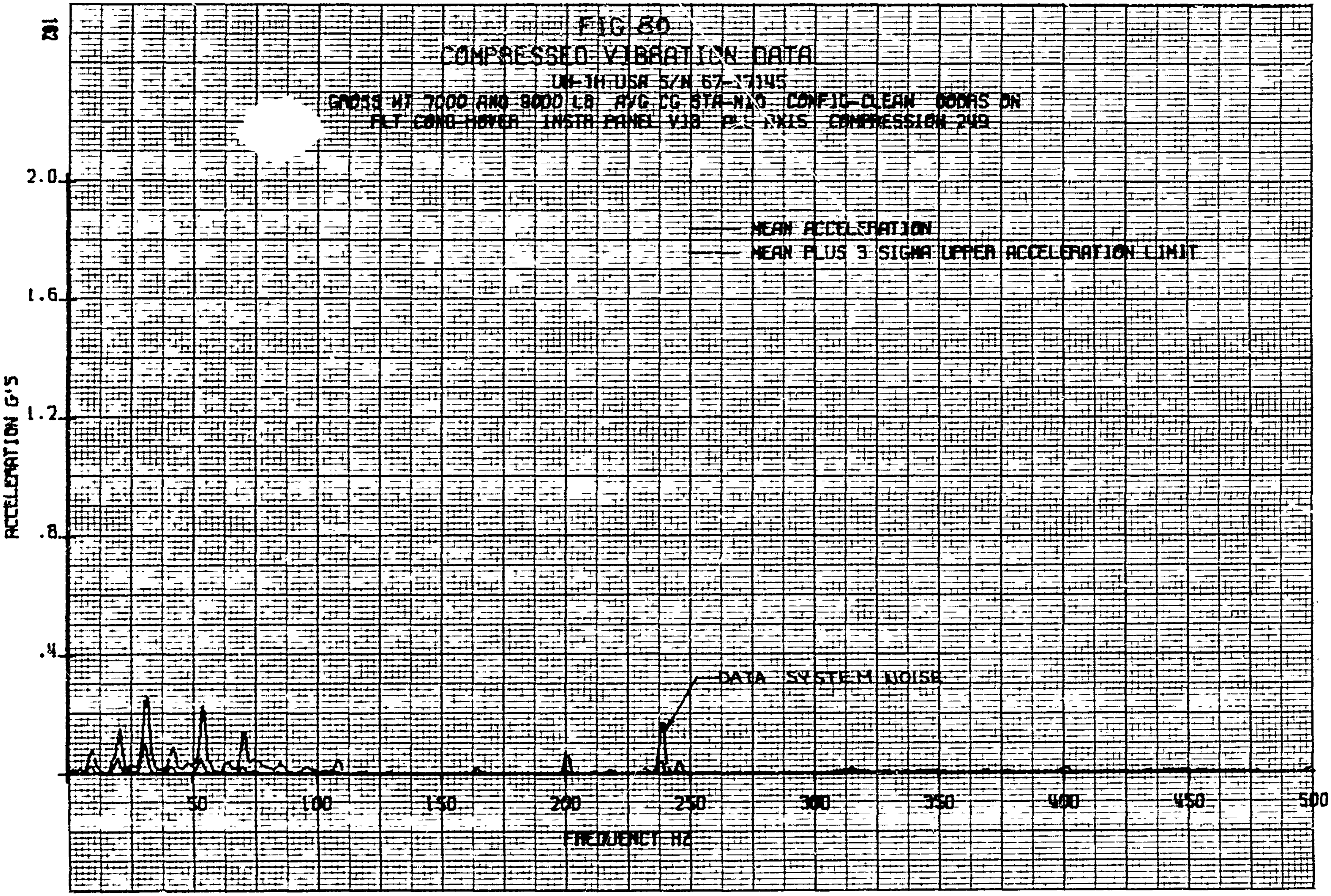


FIG 80
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 8000 LB AVG CG STA-MID CONFIG-CLEAN DOORS ON
FLT COND-HOVER INSTR PANEL V18 AXIS COMPRESSION 249
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

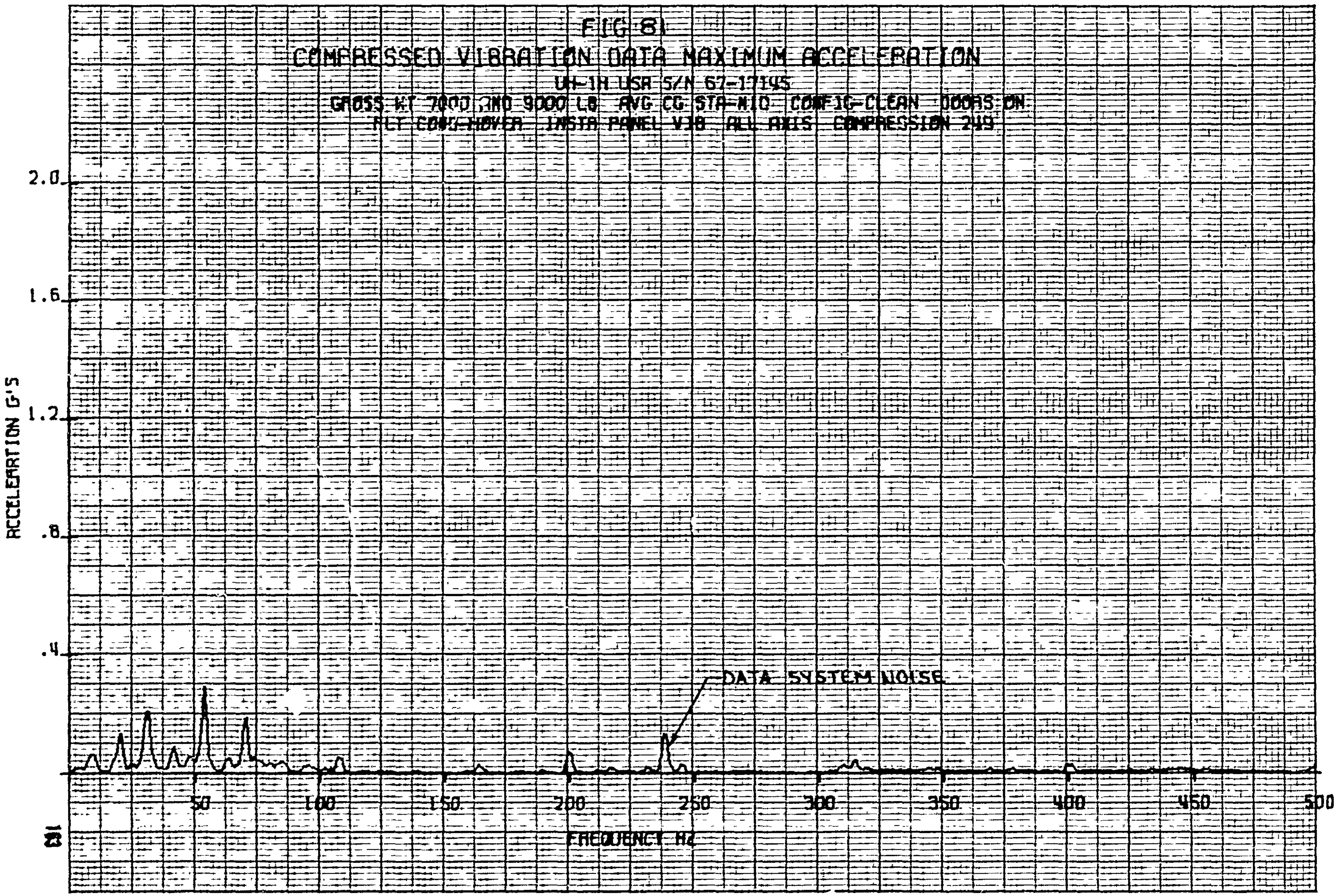


FIG 81
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS ON
FLT COND-HOVER INSTR PANEL V30 ALL AXIS COMPRESSION 249
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
DATA SYSTEM NOISE
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

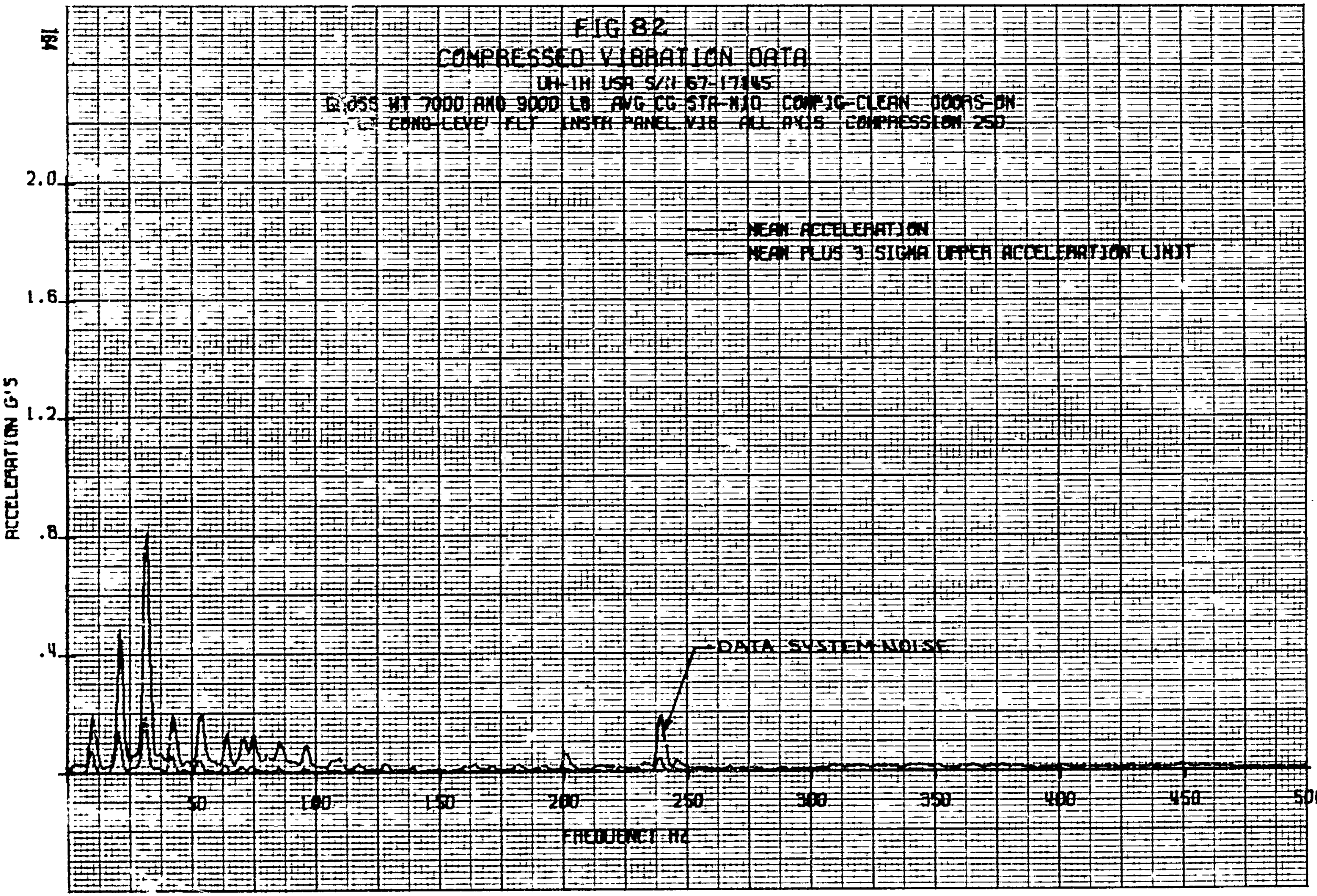

COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-N10 CONFIG-CLEAN DOORS-ON
CONO-LEVEL FLT INSTR PANEL V18 ALL AXIS COMPRESSION 250
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

FIG 82

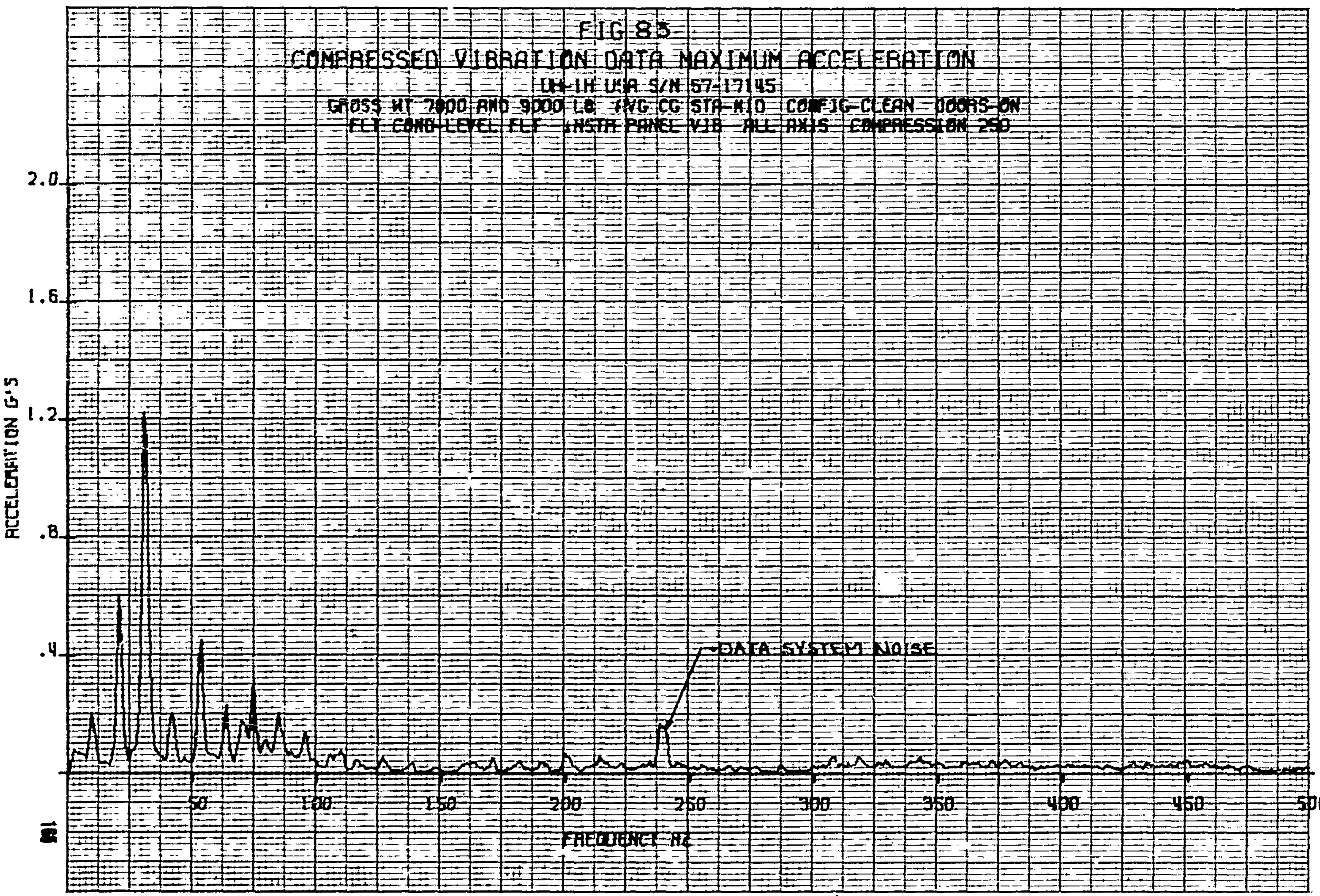


FIG 83
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 57-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND-LEVEL FLT INSTR PANEL V18 ALL AXIS COMPRESSION 250
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
DATA SYSTEM NOISE
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

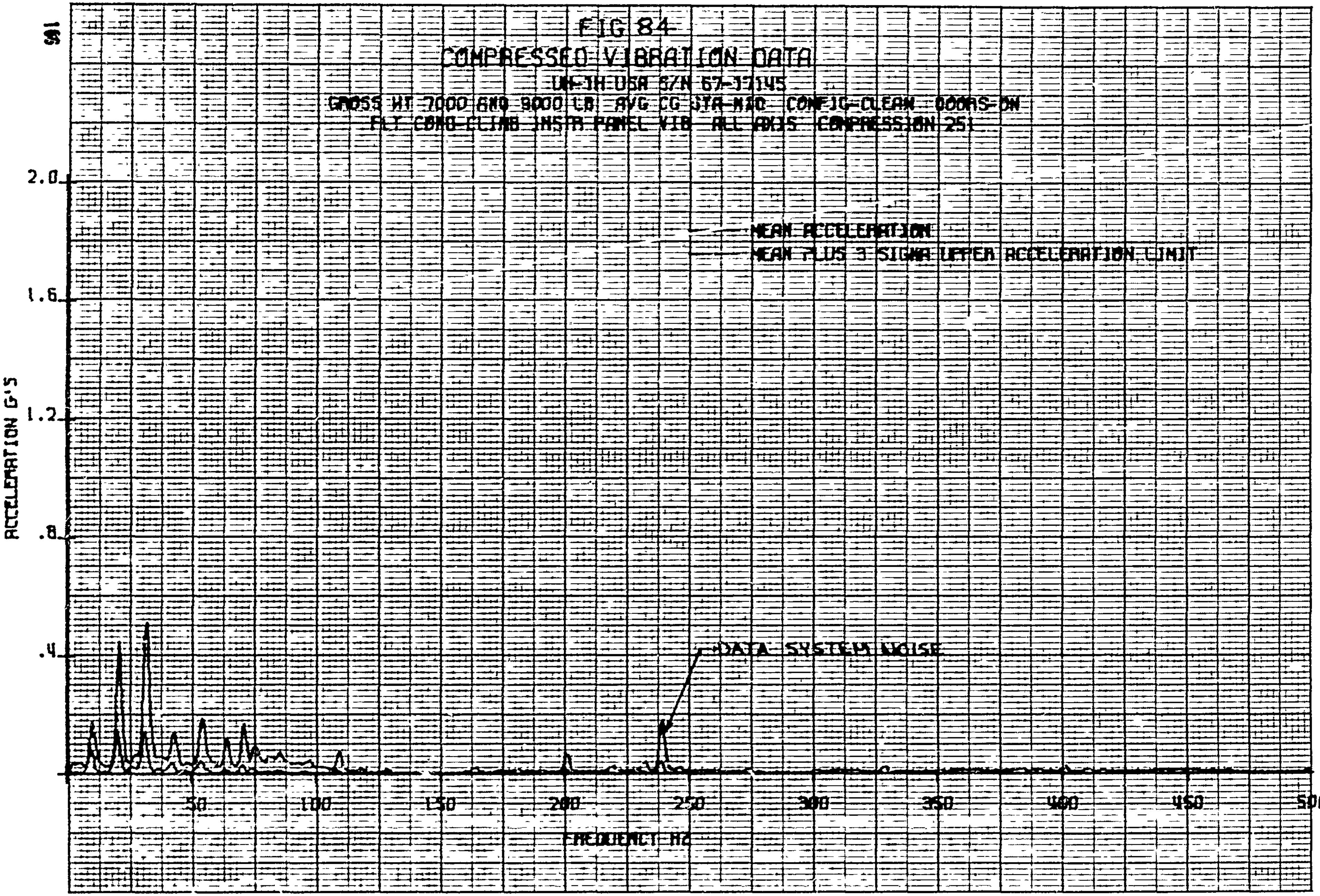


FIG 84
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND-CLIMB INSTR PANEL VIB ALL AXIS COMPRESSION 251
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

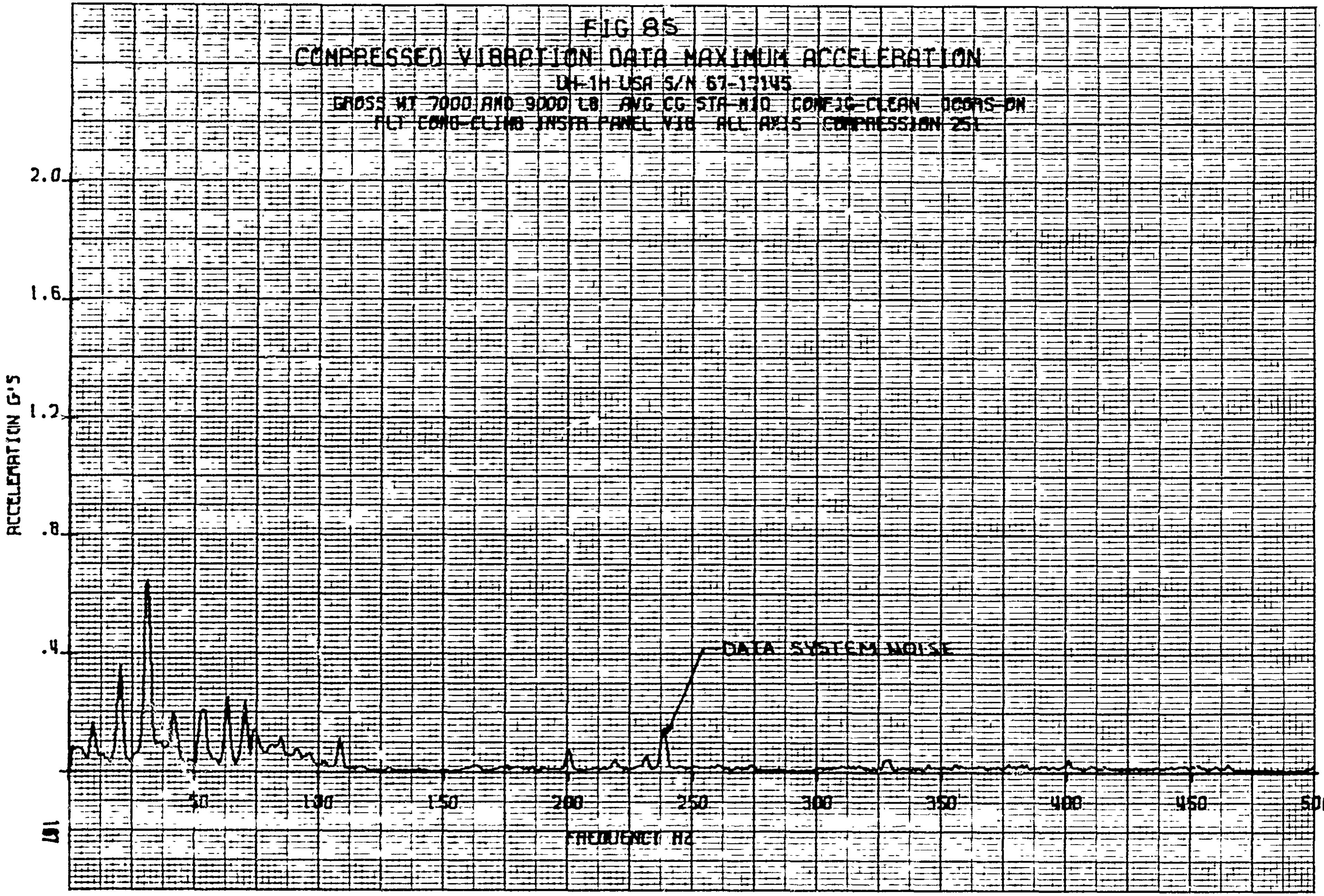
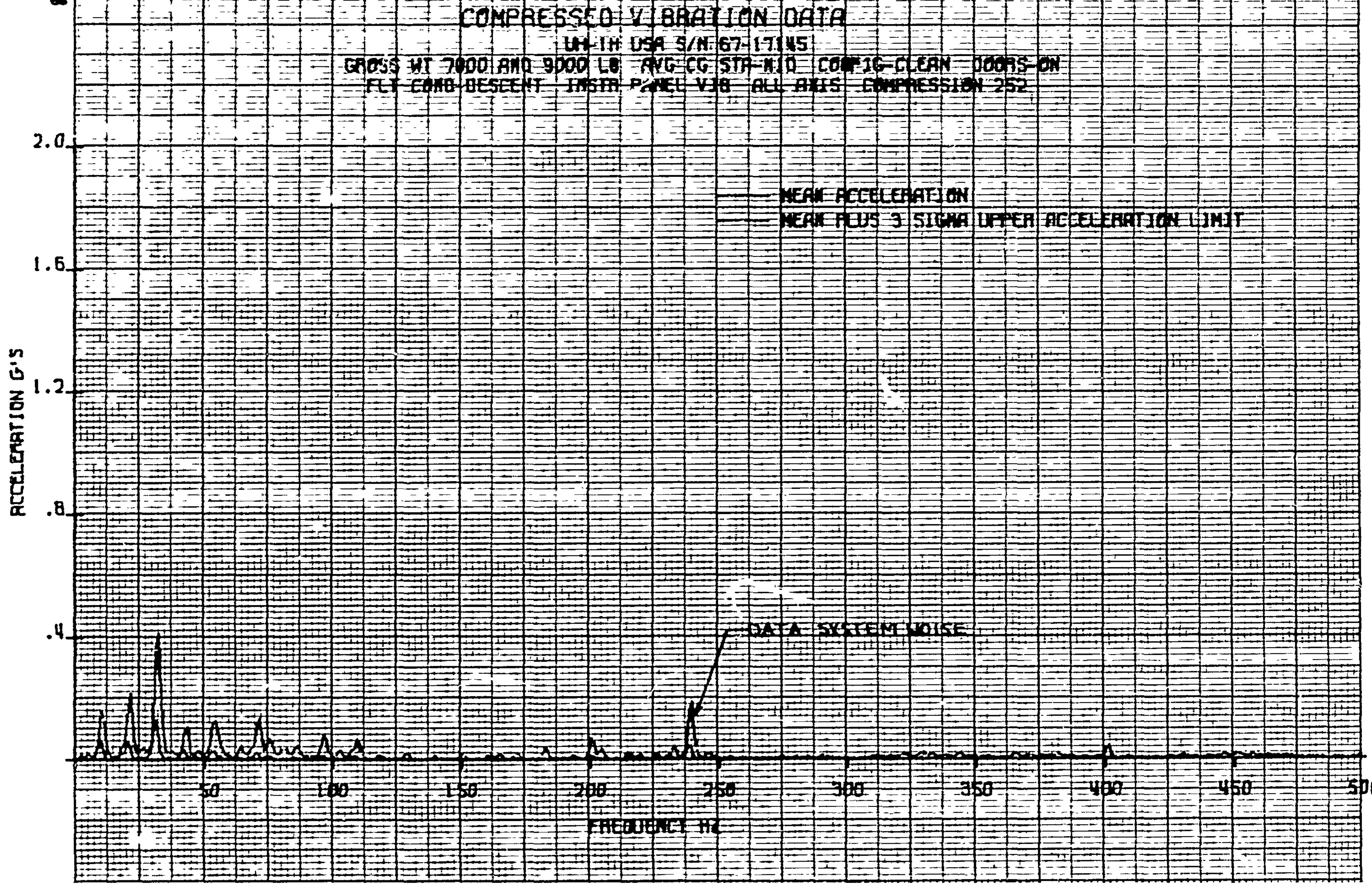


FIG 85
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-M10 CONFIG-CLEAN DOORS-ON
FLT COND-CLIMB INSTR PANEL VIB ALL AXIS COMPRESSION 251
DATA SYSTEM NOISE
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

FIG 86


COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND-DESCENT INSTR PANEL V38 ALL AXIS COMPRESSION 252
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

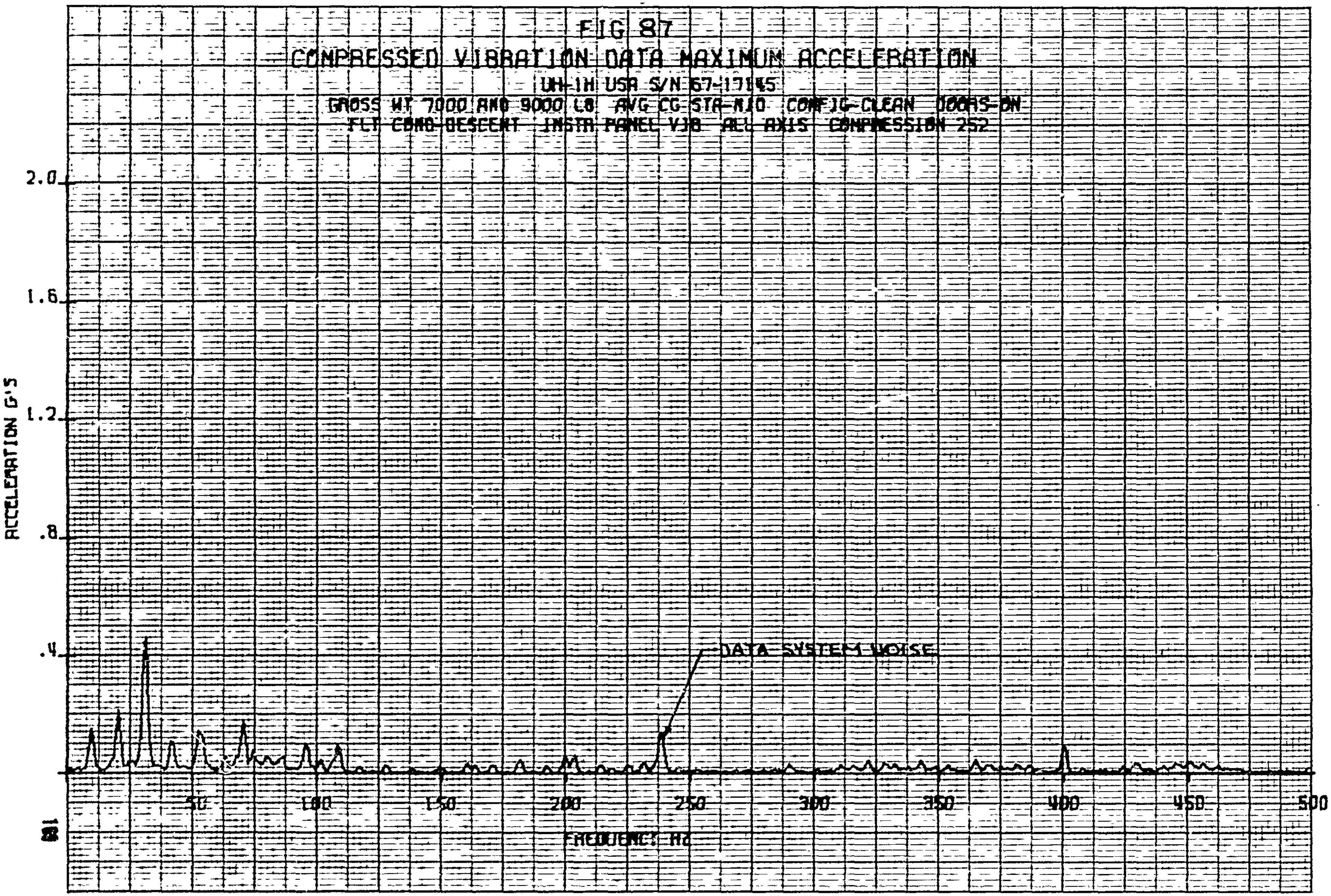


FIG 87
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-N10 CONFIG-CLEAN DOORS-ON
FLT COND-DESCENT INSTR PANEL VJB ALL AXIS COMPRESSION 252

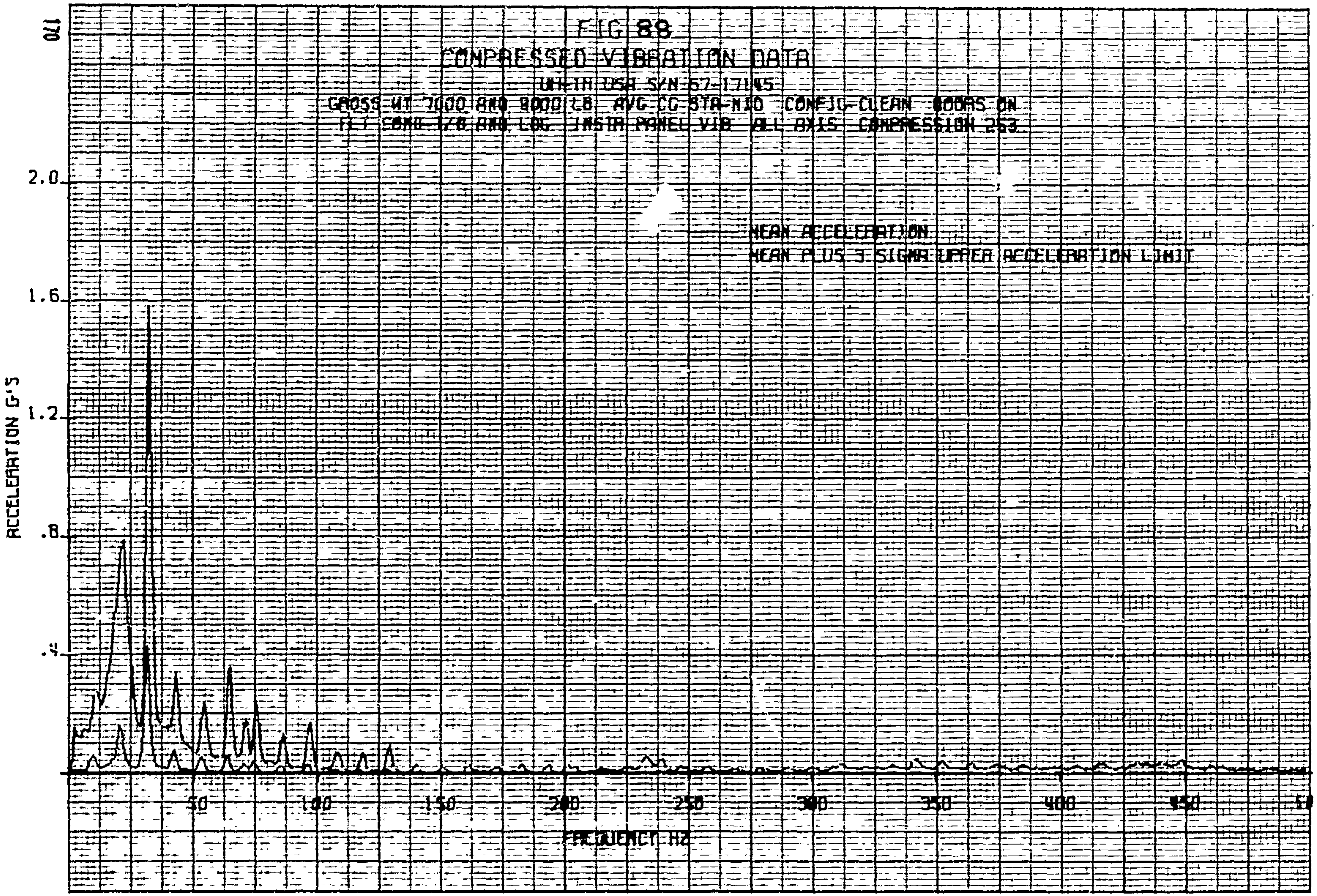


FIG 88
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-N10 CONFIG-CLEAN DOORS ON
FLT COND 1/0 AND LOG INSTR PANEL VIB ALL AXIS COMPRESSION 253
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

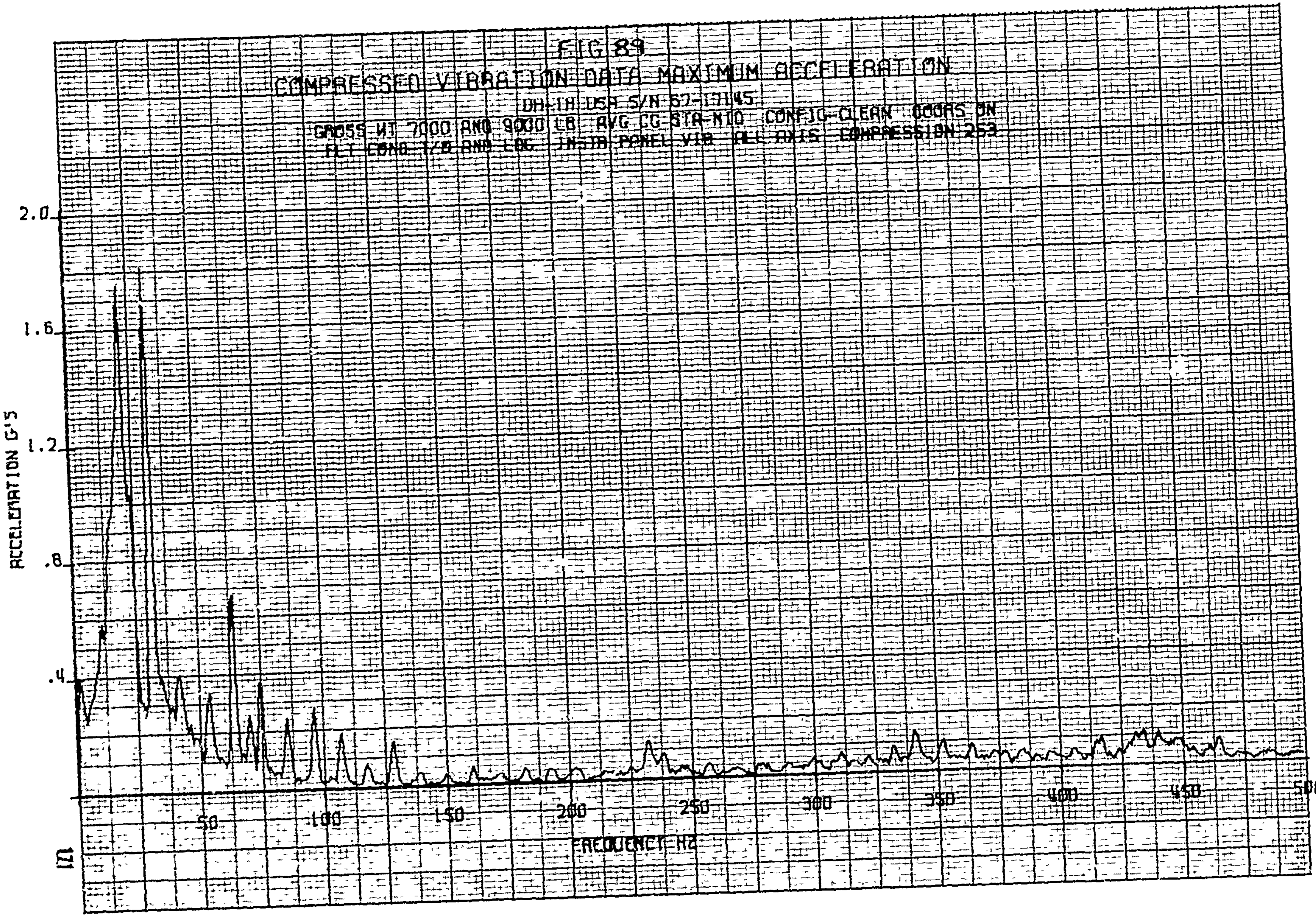


FIG 89
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA MID CONFIG CLEAN DOORS ON
FLT COND 1/0 AND LOG INSTR PANEL VIB ALL AXIS COMPRESSION 253
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

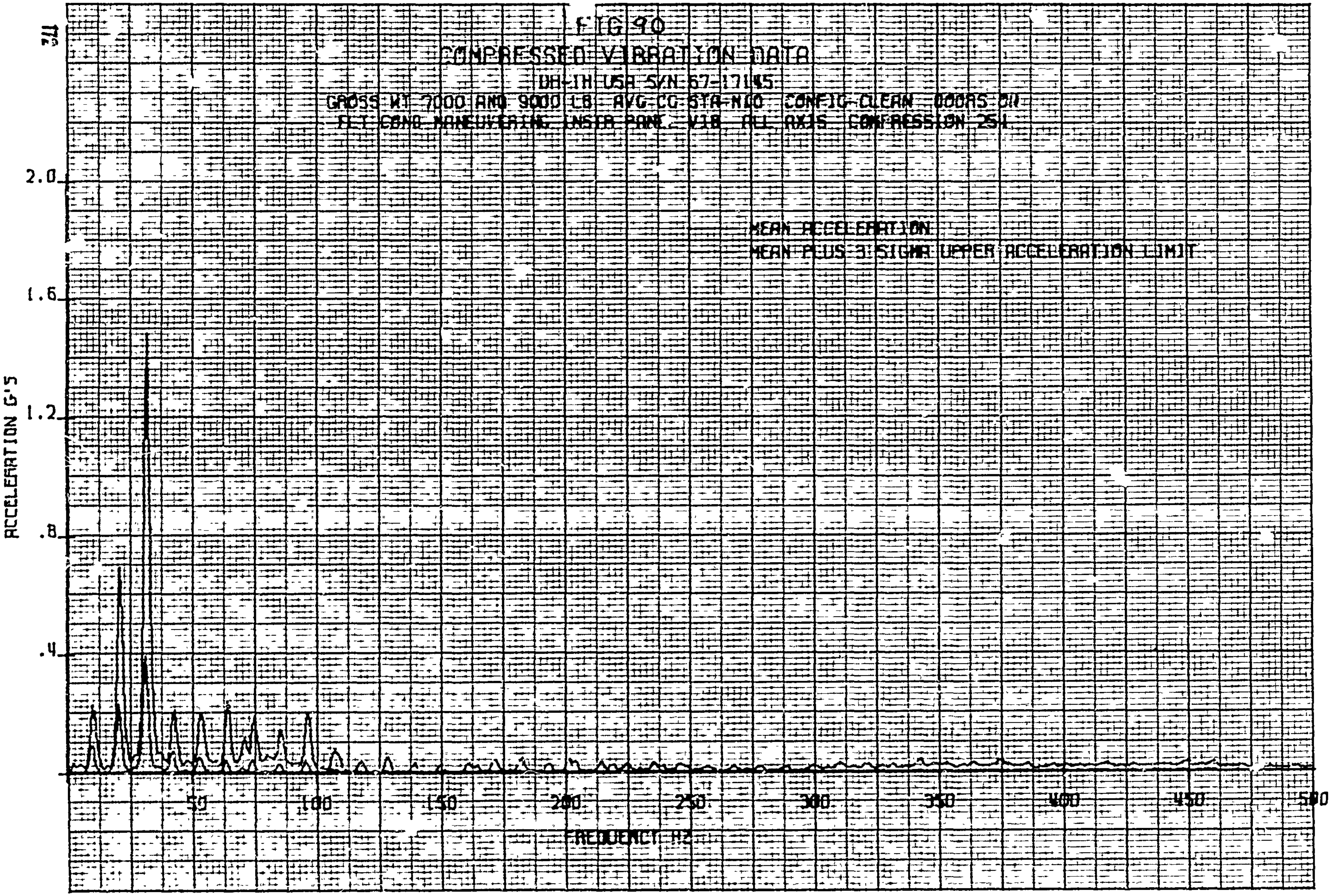


FIG 90
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-N10 CONFIG-CLEAN DOORS ON
FLT COND MANEUVERING INSTR PANL V18 ALL AXIS COMPRESSION 25%
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

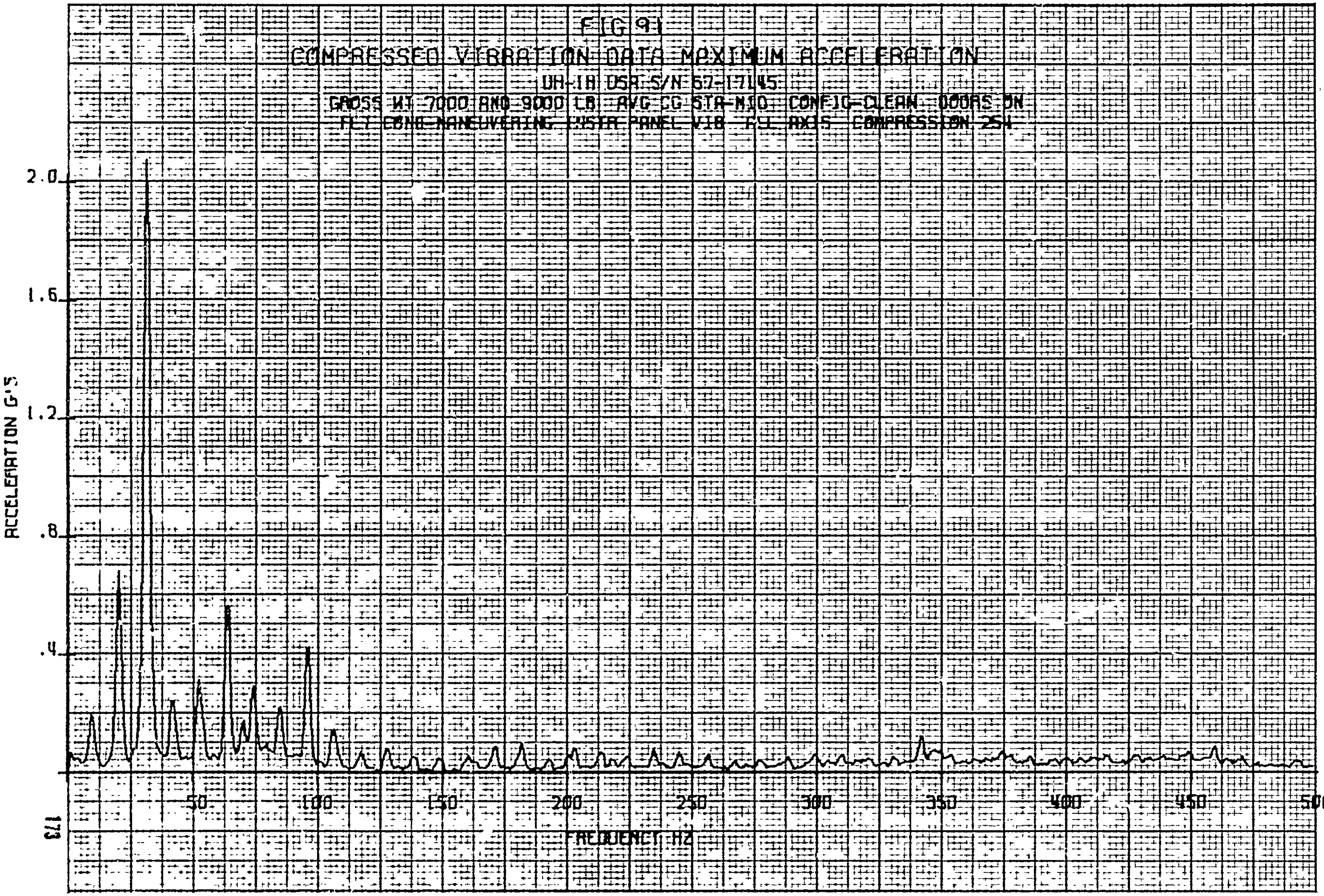


FIG 91
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H DSR S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-N10 CONFIG-CLEAN DOORS ON
FLT COND-MANEUVERING INSTR PANEL VIB F/L AXIS COMPRESSION 25%
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

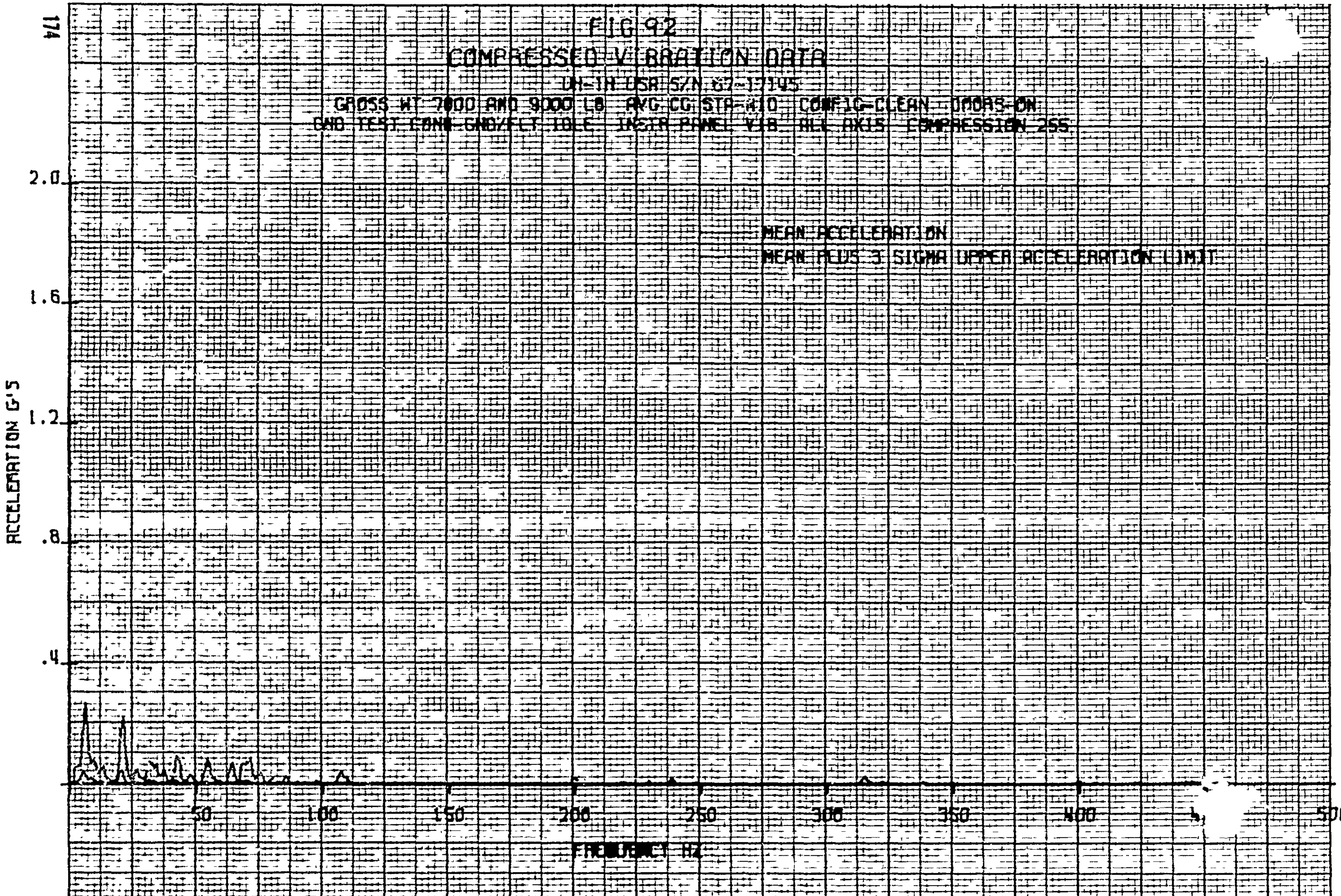


FIG 92
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-410 CONFIG-CLEAN DMARS-ON
GND TEST COND-GND/FLT IDLE INSTR PANEL V18 ALL AXIS COMPRESSION 255
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
500
FREQUENCY HZ

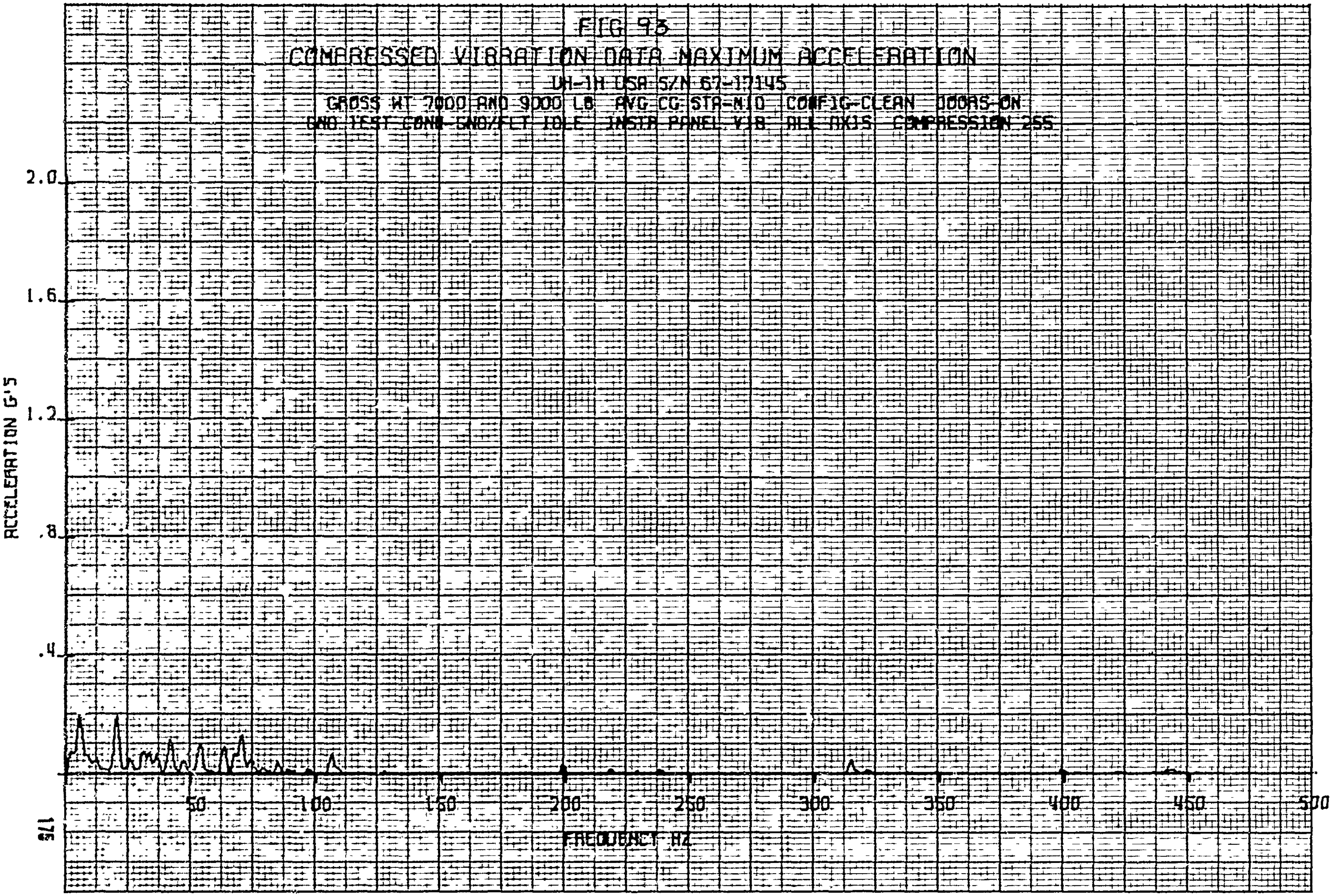


FIG 93
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
GND TEST COND GND/FLT IDLE INSTR PANEL V18 ALL AXIS COMPRESSION 255
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

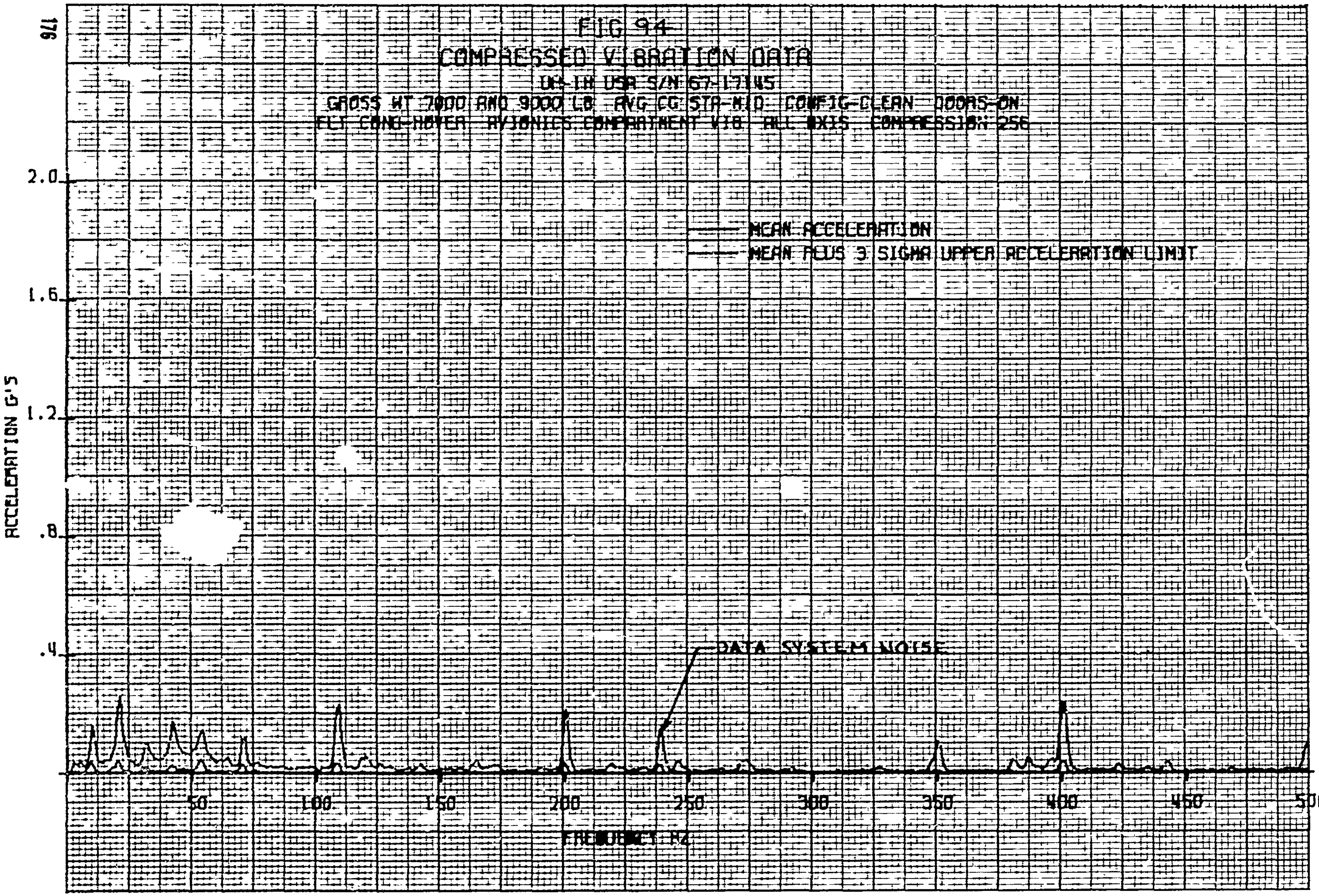


FIG 94
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND-HOVER AVIONICS COMPARTMENT VIB ALL AXIS COMPRESSION 256
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

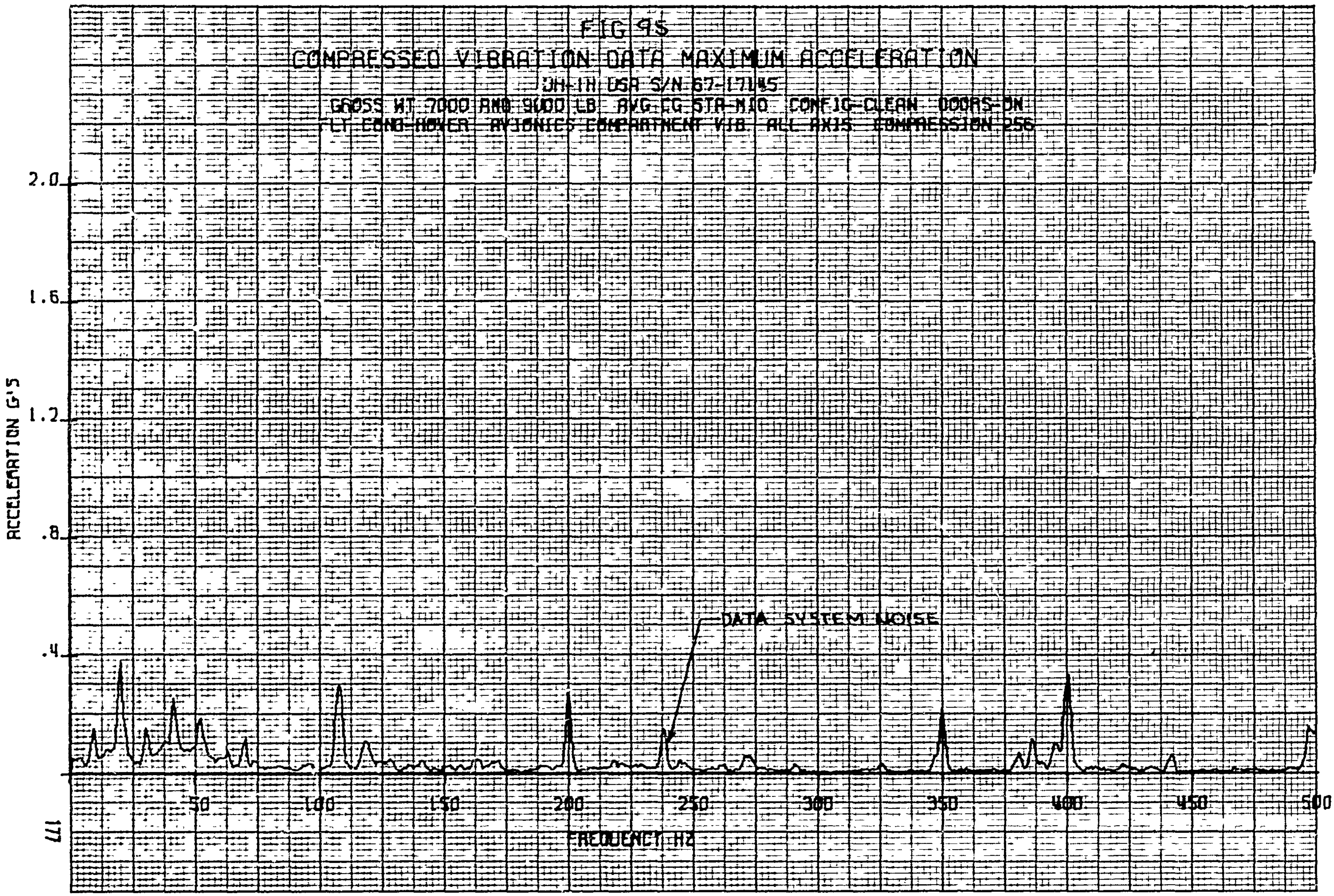


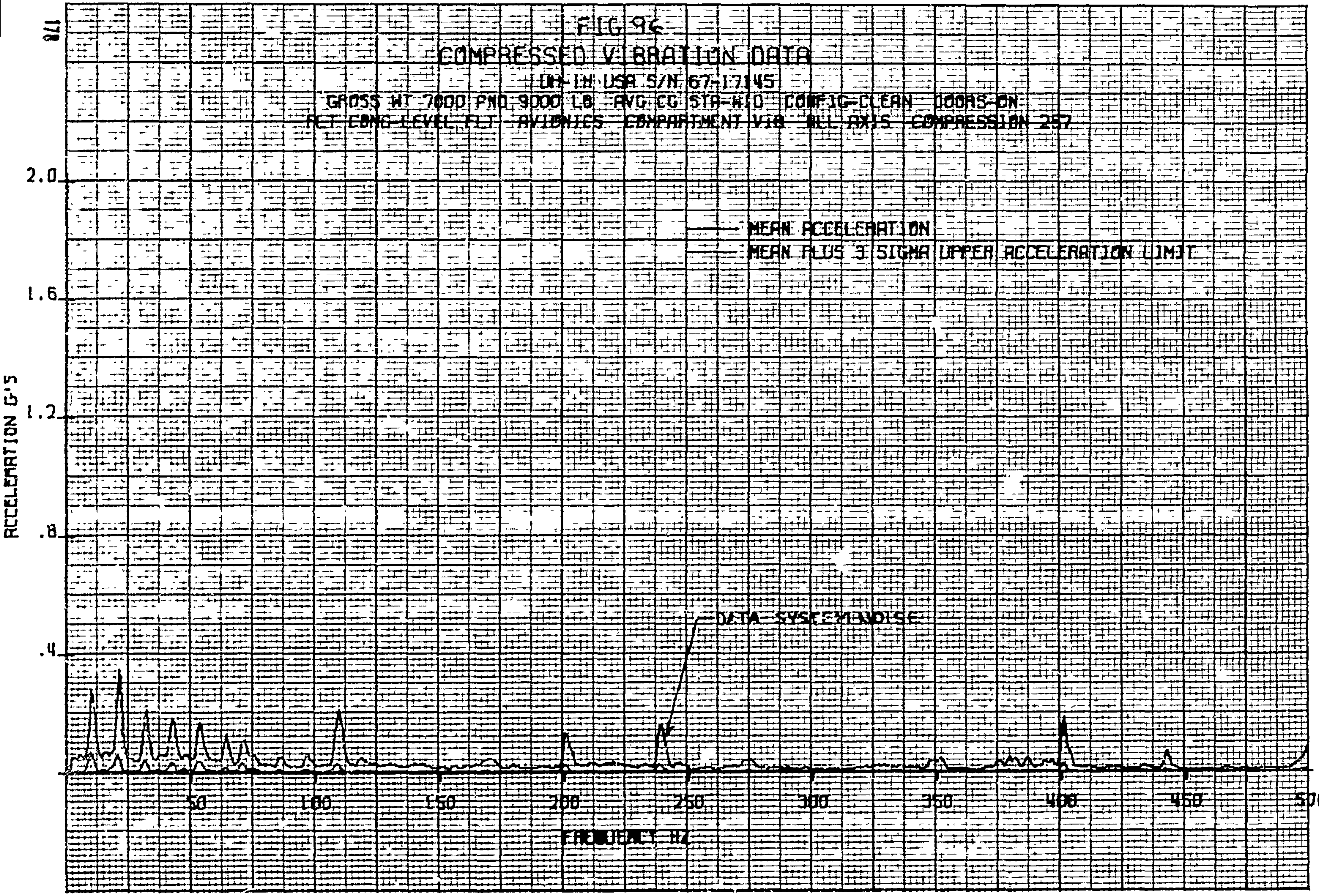
FIG 95

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

JH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000 LB AVG CG STA-M10 CONFIG-CLEAN DOORS-ON

FLT COND-HOVER AVIONICS COMPARTMENT VIB ALL AXIS COMPRESSION 256


178
FIG 96
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-130 CONFIG-CLEAN DOORS-ON
ALT COND-LEVEL FLT AVIONICS COMPARTMENT VIB ALL AXIS COMPRESSION 257
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

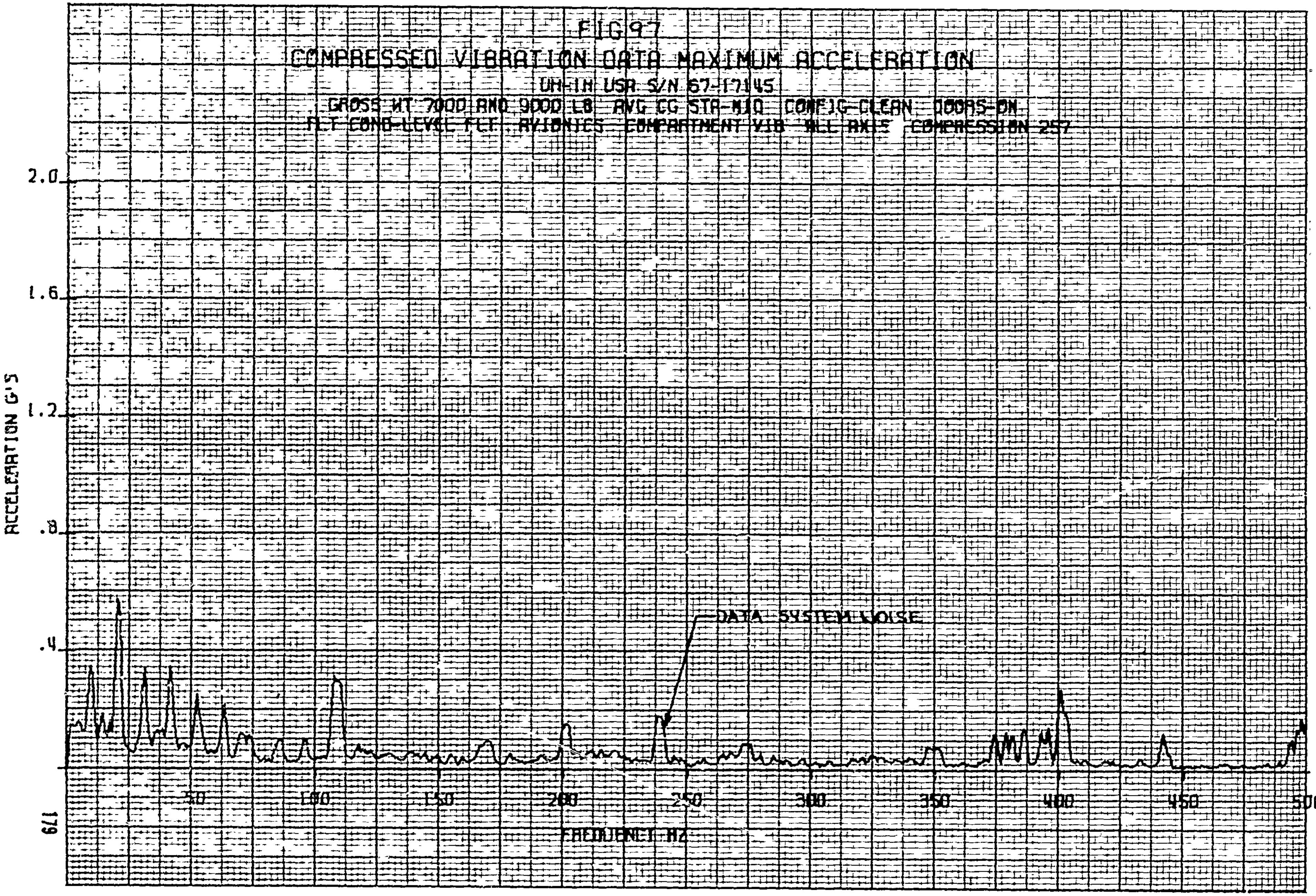


FIG 97
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND-LEVEL FLT AVIONICS COMPARTMENT VIB ALL AXIS COMPRESSION 257
DATA SYSTEM NOISE
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

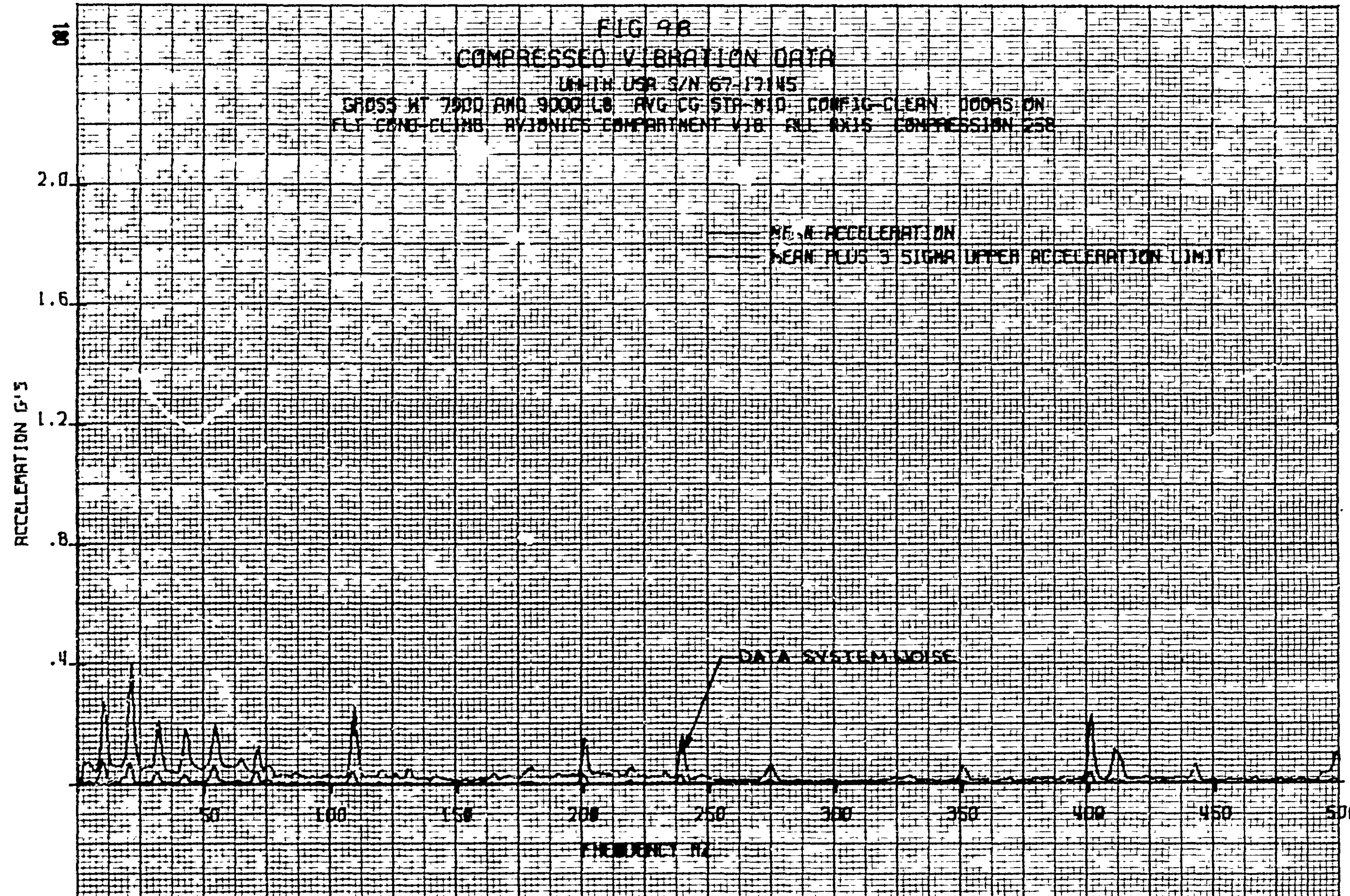


FIG 9B
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7900 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS ON
FLT COND-CLIMB AVIONICS COMPARTMENT VIB ALL AXIS COMPRESSION 258
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ
ACCELERATION G'S

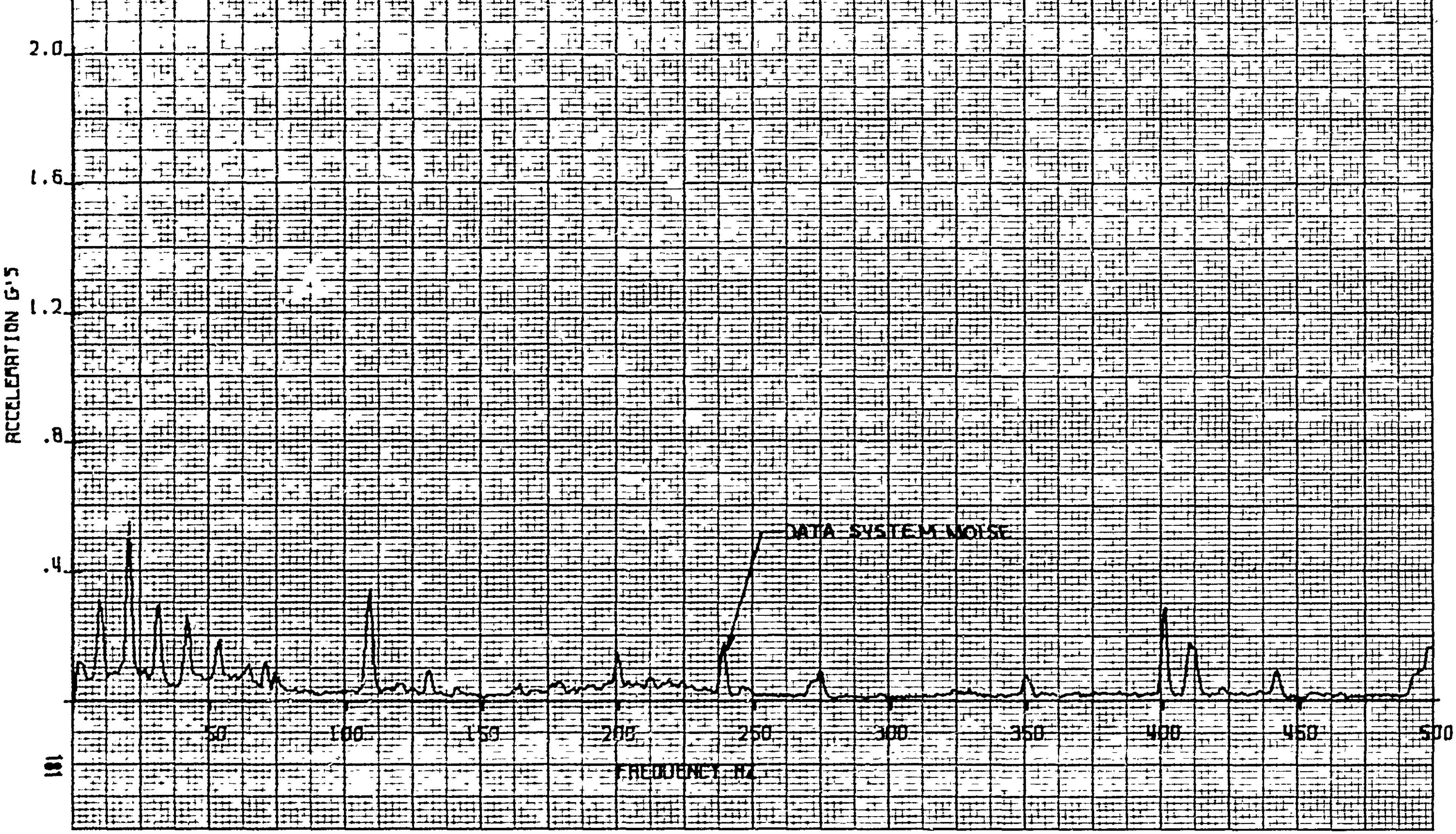
FIG 99

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS ON

FLT COND-CLIMB AVIONICS COMPARTMENT VIB ALL AXIS COMPRESSION 258



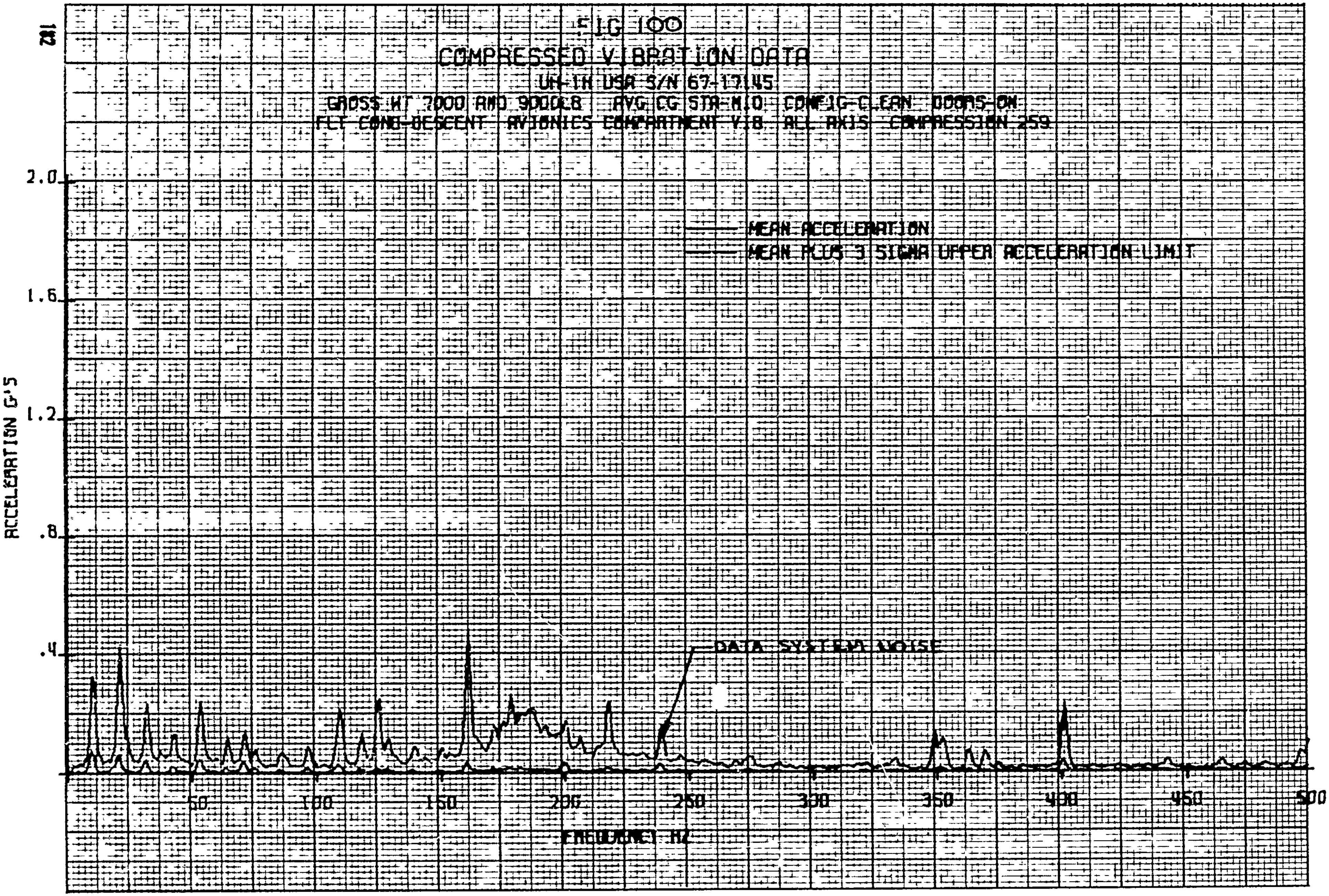


FIG 100
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-N.O CONFIG-CLEAN DOORS-ON
FLT COND-DESCENT AVIONICS COMPARTMENT VIB ALL AXIS COMPRESSION 259
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

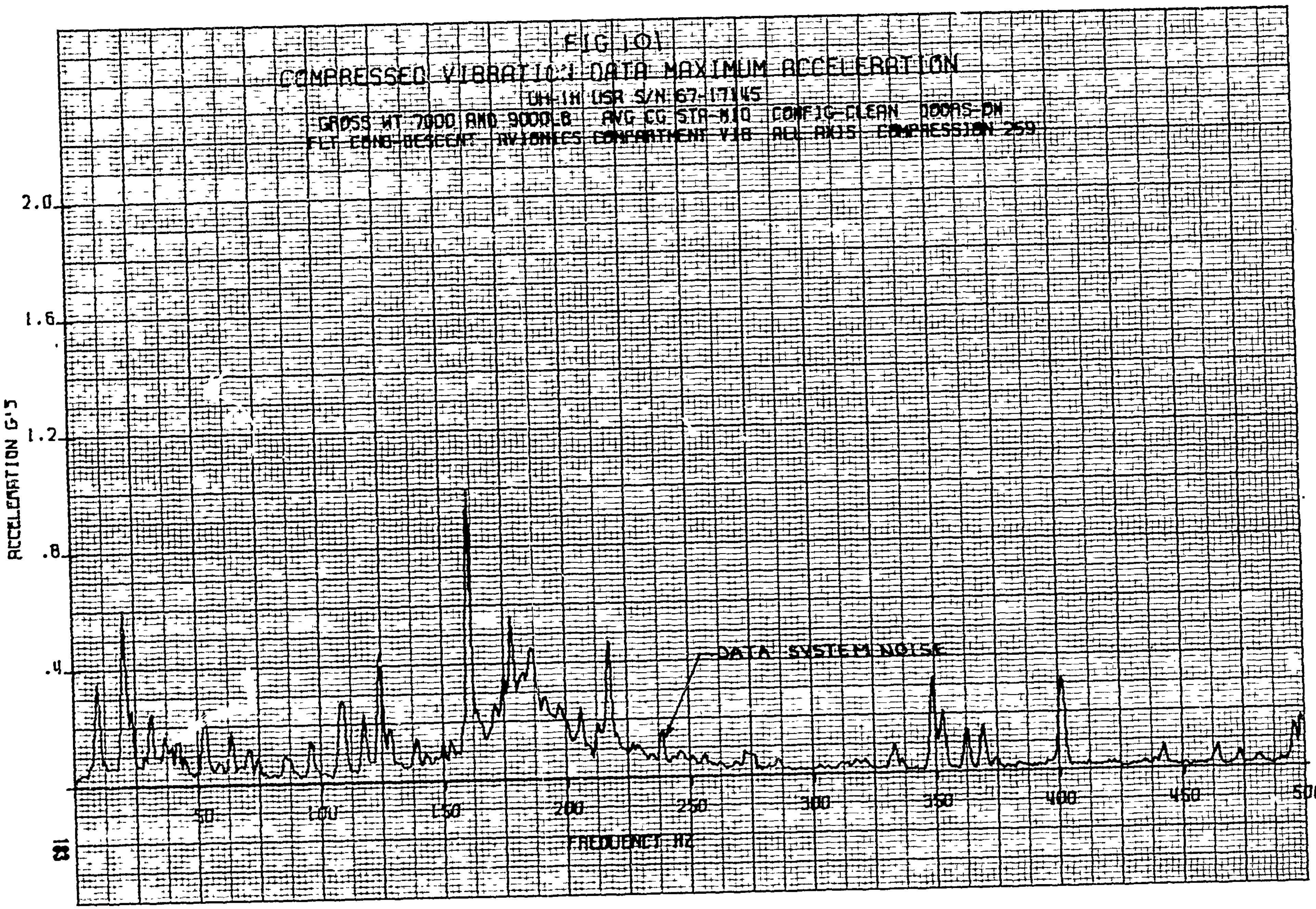


FIG 101
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND-DESCENT AVIONICS COMPARTMENT V18 ALL AXIS COMPRESSION 259
DATA SYSTEM NOISE
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

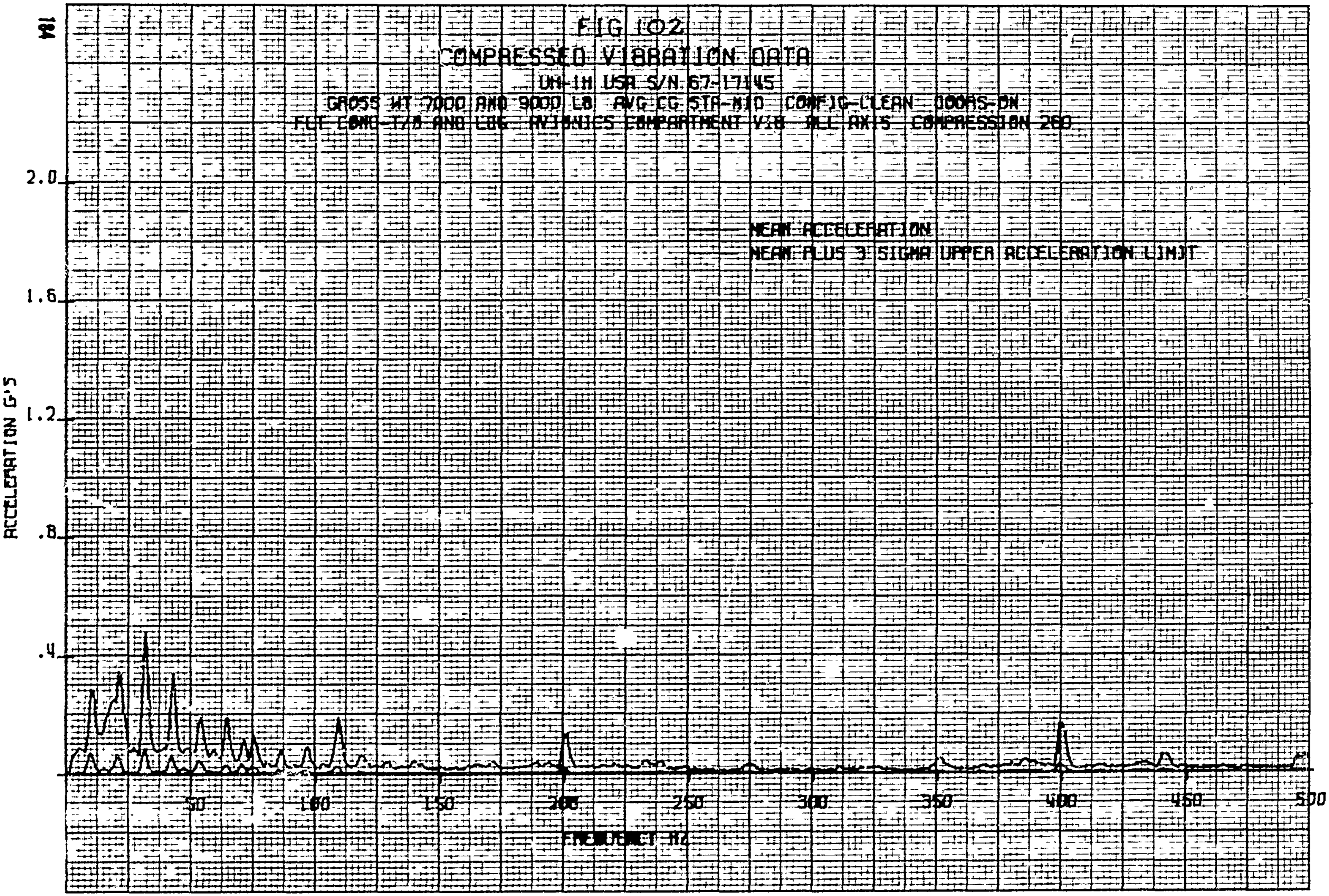


FIG 102
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND-T/O AND LDG AVIONICS COMPARTMENT VIB ALL AXIS COMPRESSION 260
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

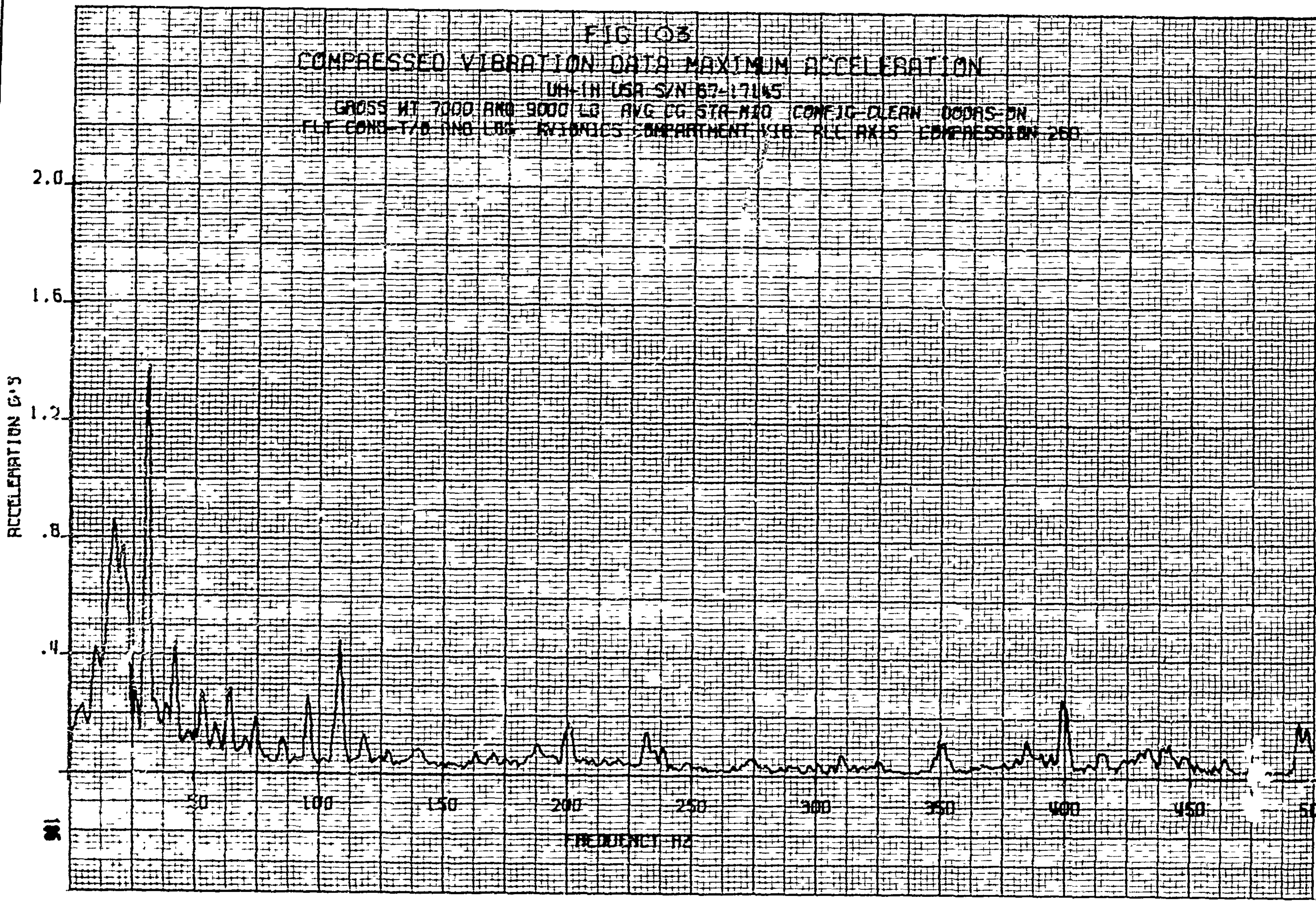


FIG 103
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-130 CONFIG-CLEAN DOORS-ON
FLT COND-T/O AND LDG AVIONICS COMPARTMENT VIB ALL AXIS COMPRESSION 260
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

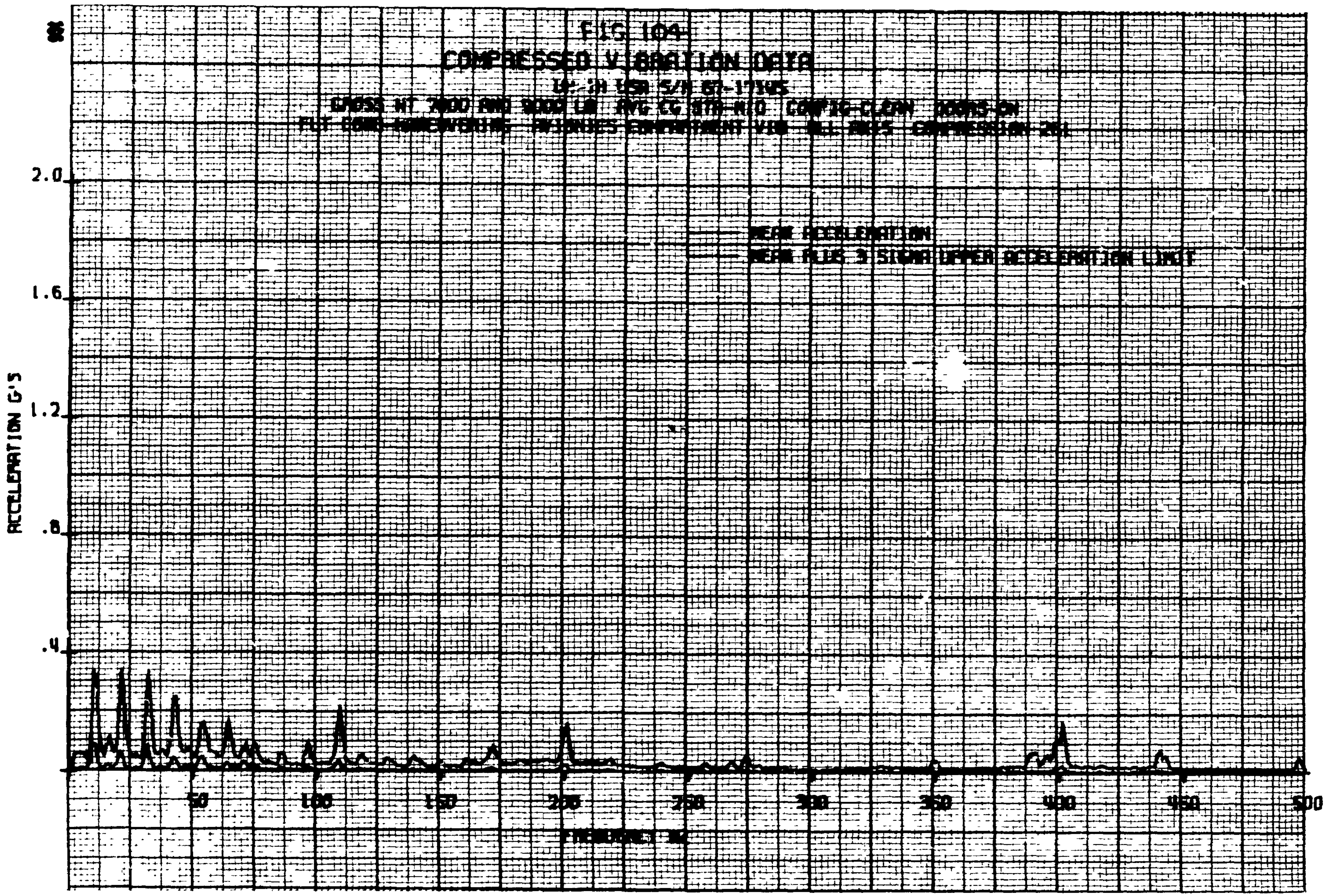


FIG 104
COMPRESSED VIBRATION DATA
GROSS WT 7000 AND 9000 LB AVG CG STA-N/O CONFIG-CLEAN DOORS-ON
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

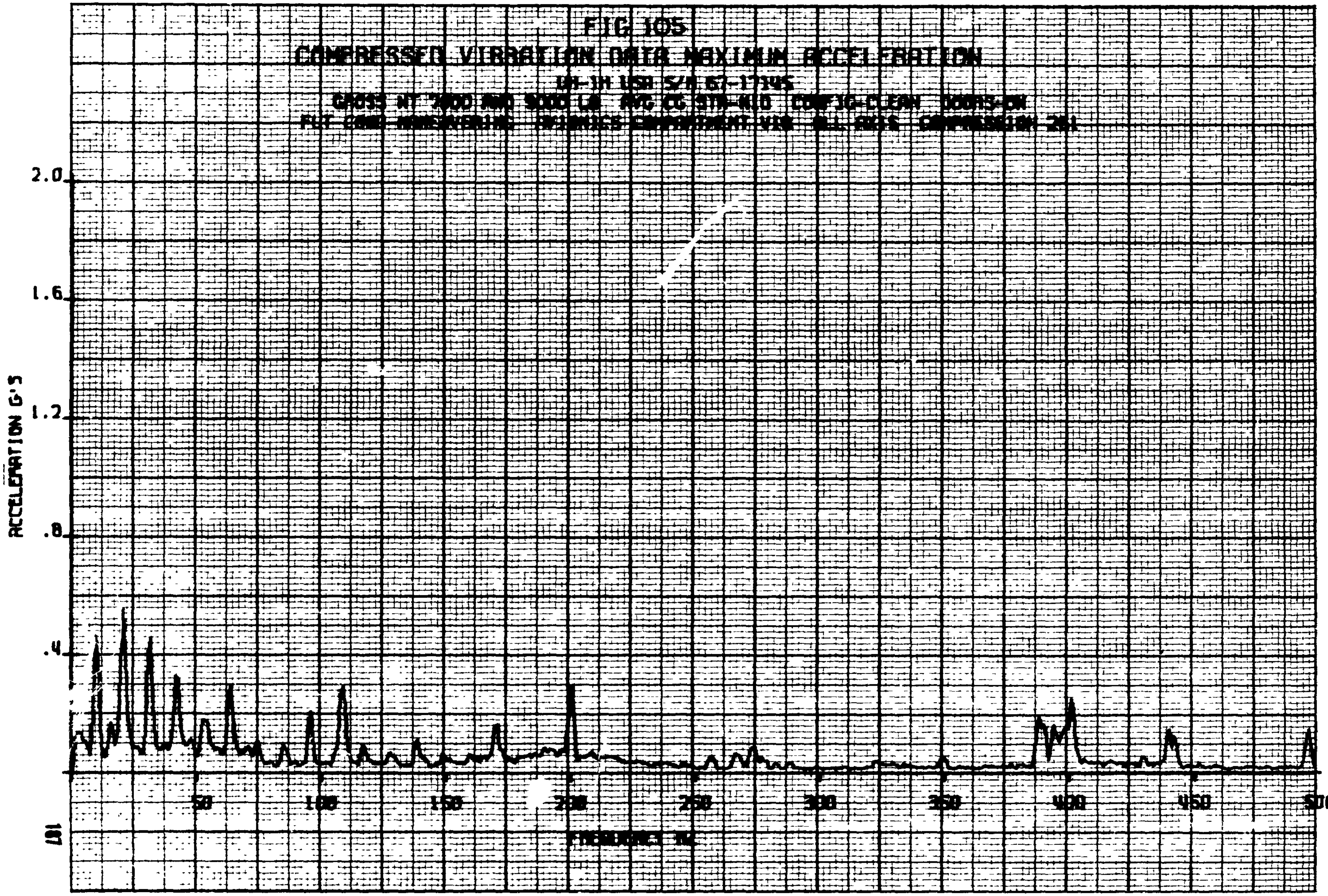


FIG 105
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

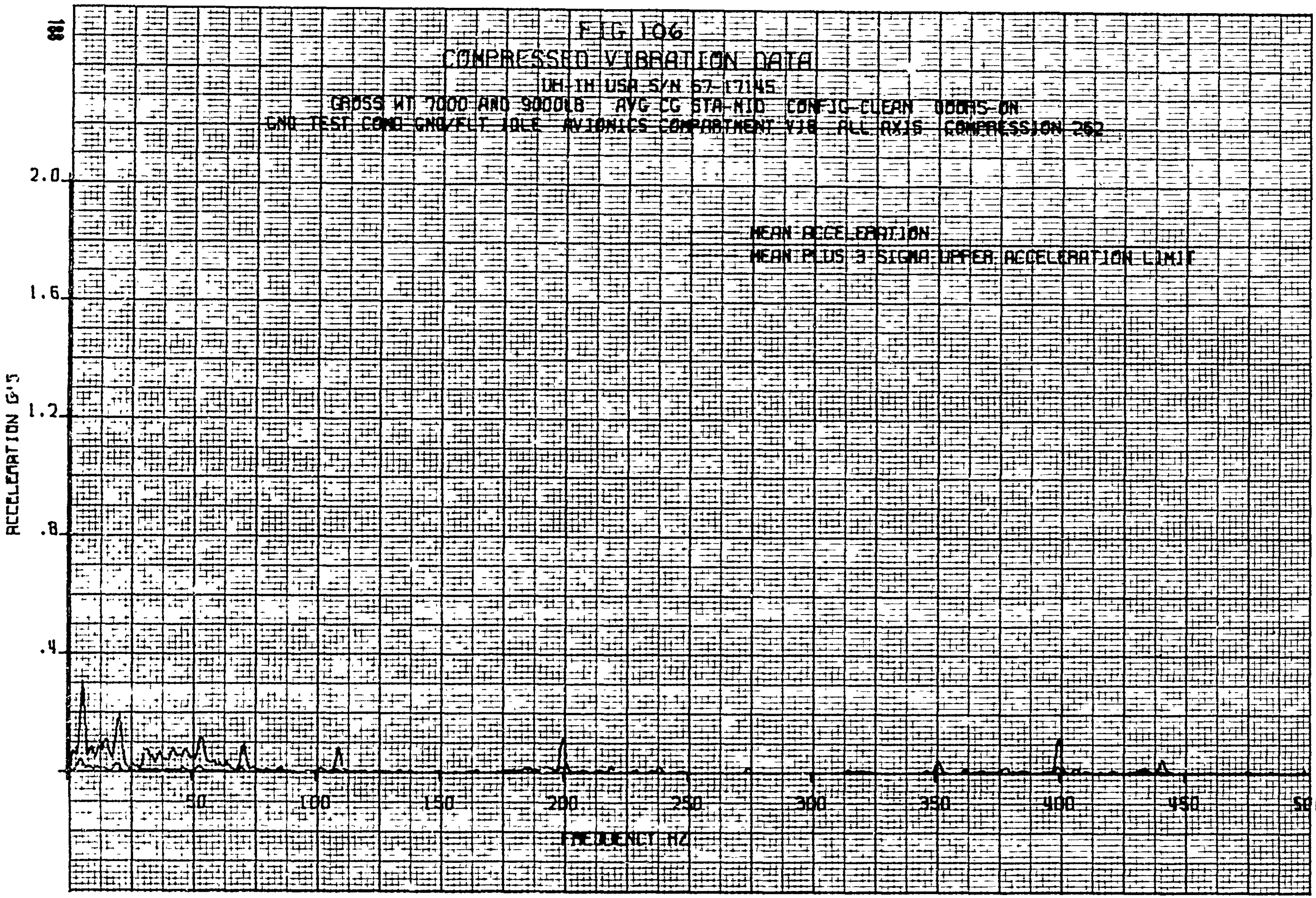


FIG 106
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
GND TEST COND GND/FLT IDLE AVIONICS COMPARTMENT VIB ALL AXIS COMPRESSION 262
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
2.0
1.6
1.2
.8
.4
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

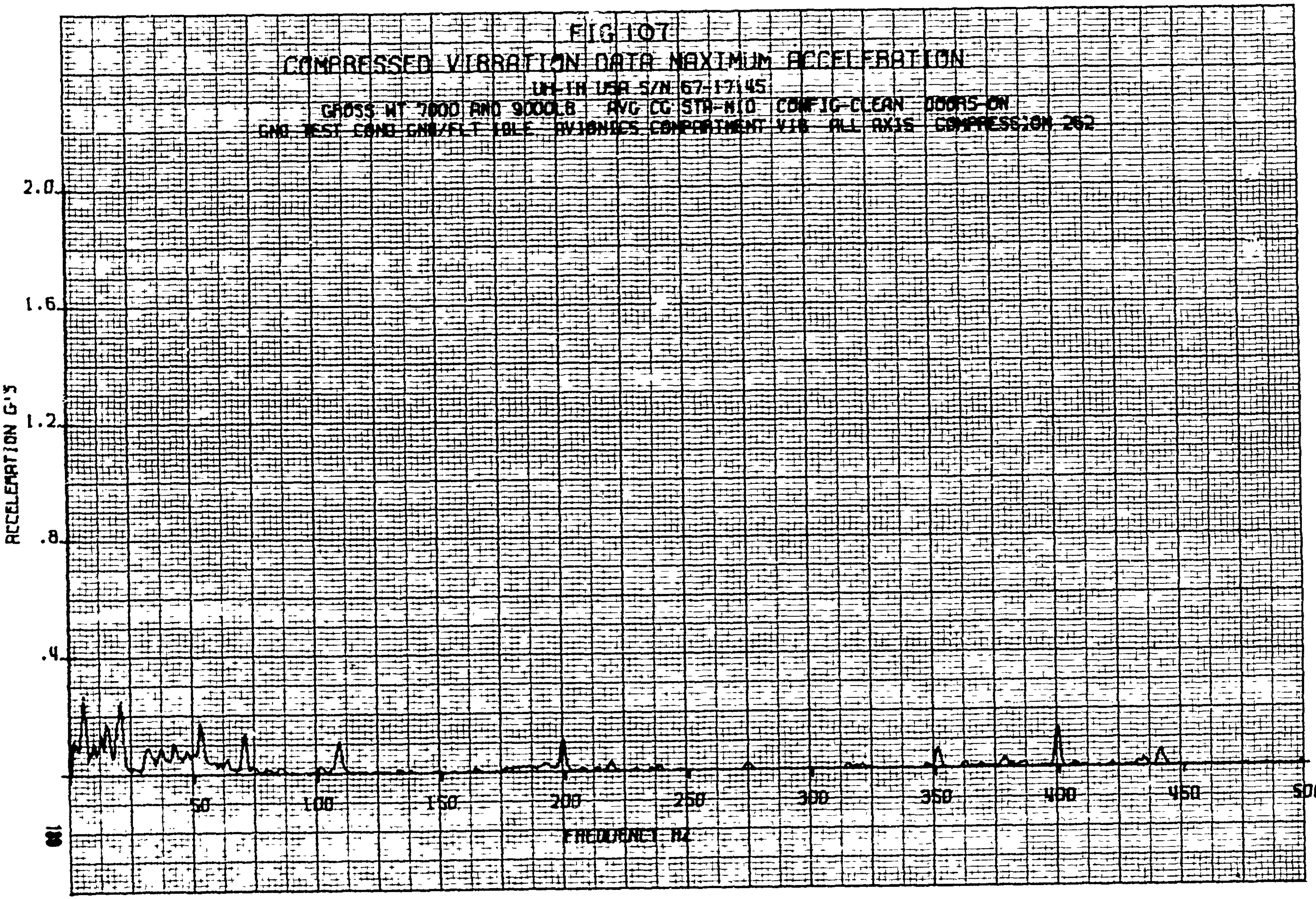


FIG 107
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
GND TEST COND GND/FLT IDLE AVIONICS COMPARTMENT VIB ALL AXIS COMPRESSION 262

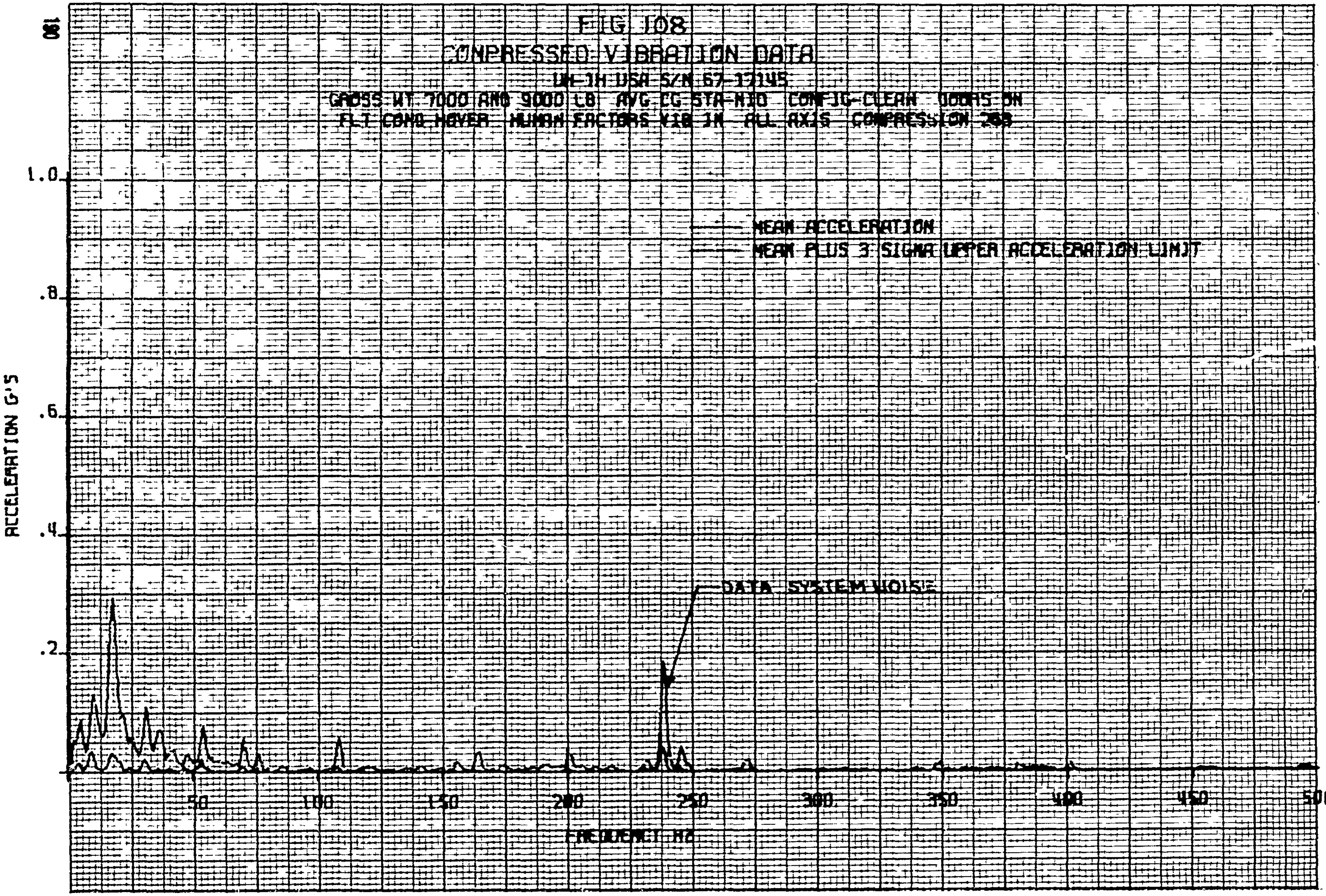


FIG 108
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-N10 CONFIG-CLEAN DOORS ON
FLT COND HOVER HUMAN FACTORS V10 1N ALL AXIS COMPRESSION 200
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

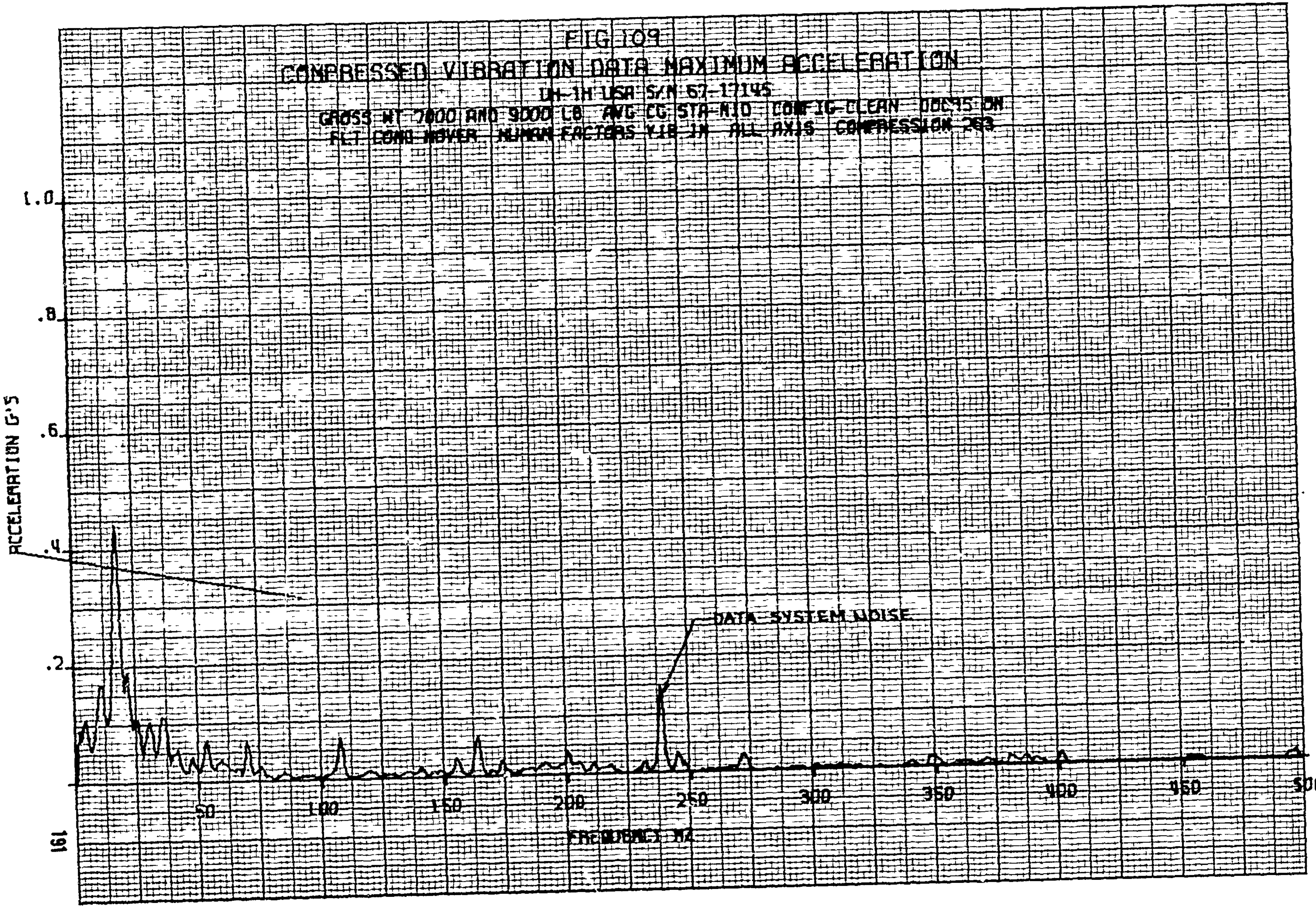


FIG 109
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN 0OC95 DN
FLT COND HOVER HUMAN FACTORS VIB IN ALL AXIS COMPRESSION 263
ACCELERATION G'S
1.0
.8
.6
.4
.2
DATA SYSTEM NOISE
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

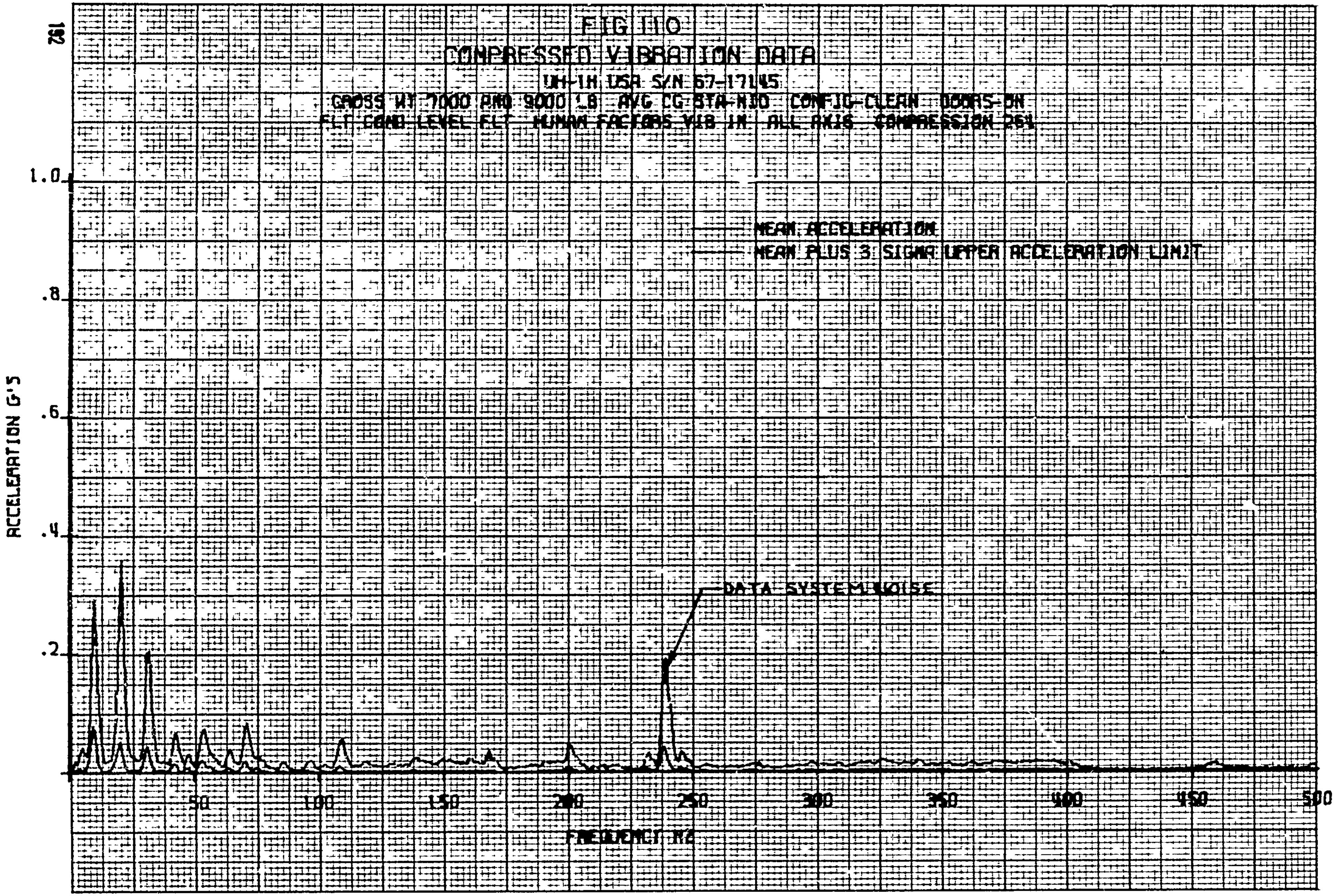


FIG 110
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND LEVEL FLT HUMAN FACTORS VIB IN ALL AXIS COMPRESSION 26%
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

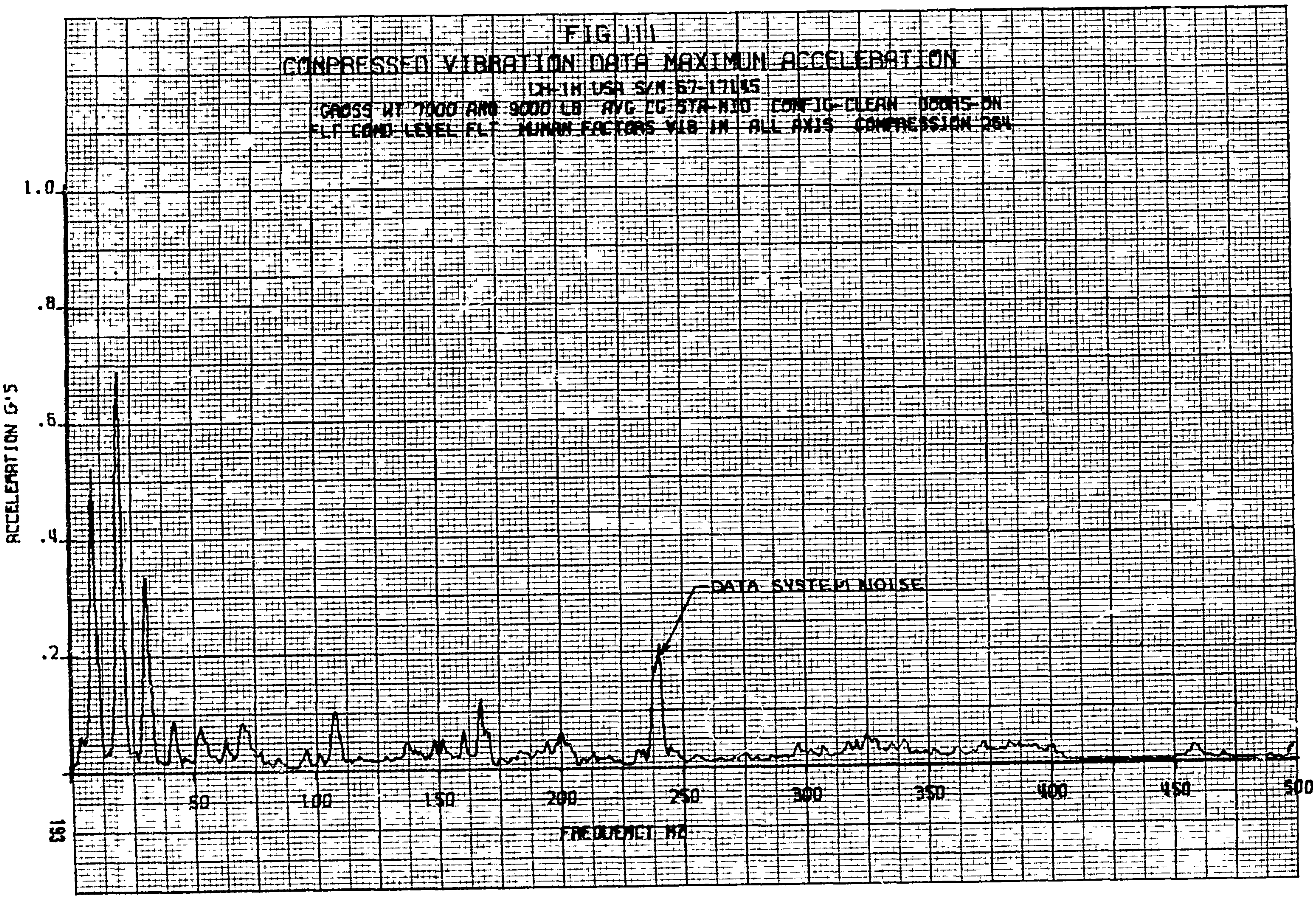
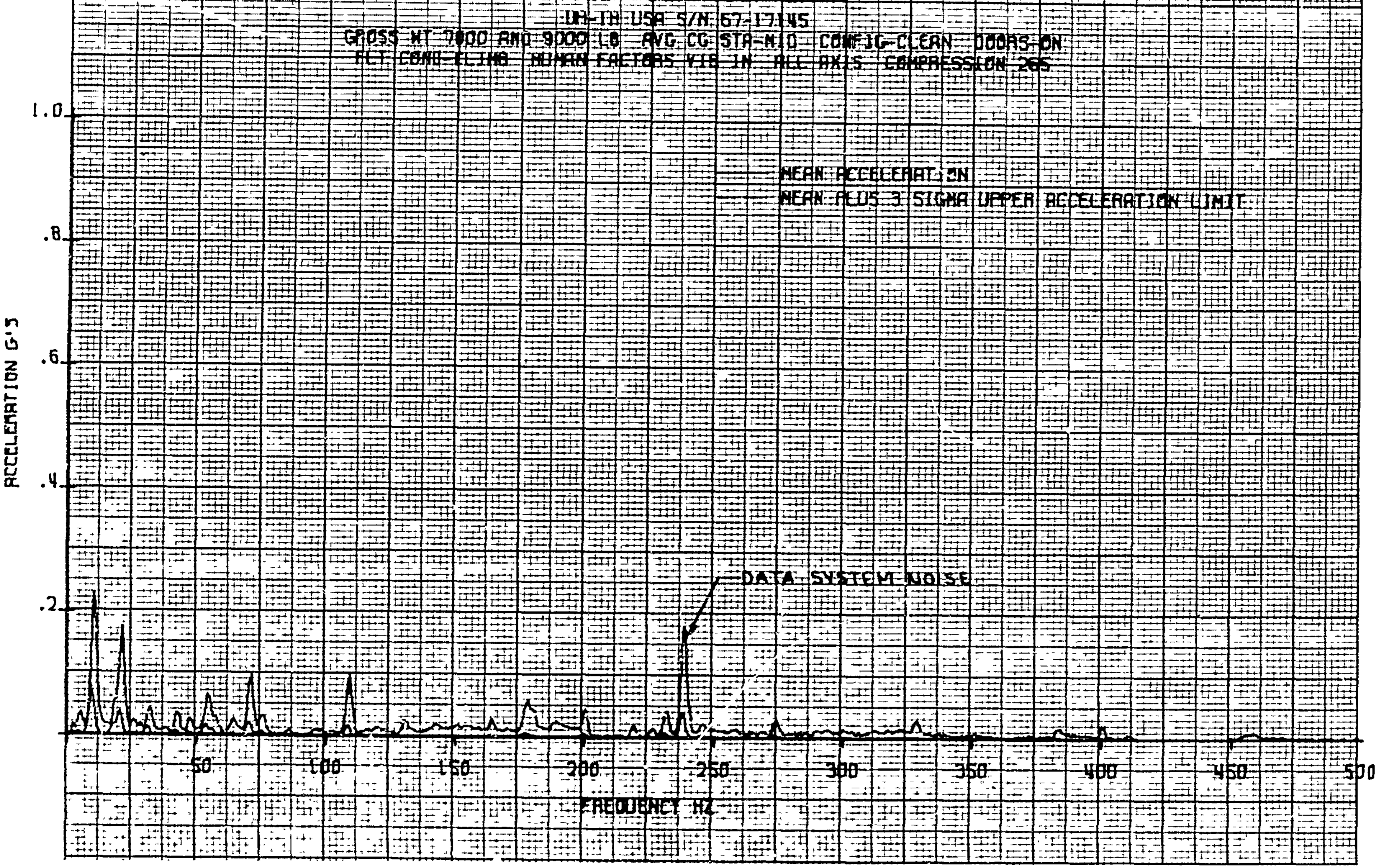


FIG 111
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-130 CONFIG-CLEAN DOORS-ON
FLT COND-LEVEL FLT HUMAN FACTORS VIB IN ALL AXIS COMPRESSION 264
ACCELERATION G'S
1.0
.8
.6
.4
.2
DATA SYSTEM NOISE
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

FIG 112

COMPRESSED VIBRATION DATA



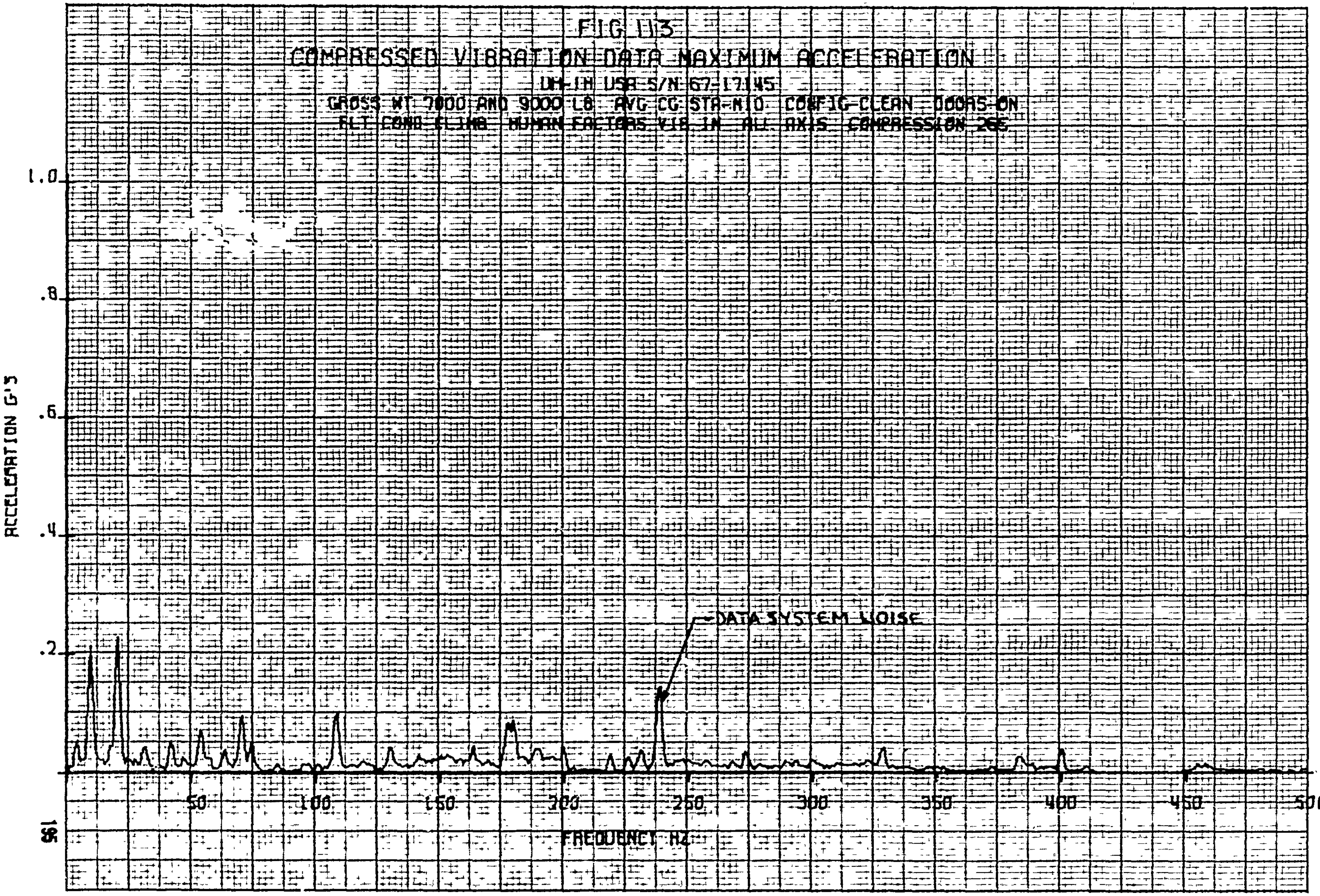


FIG 113
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS ON
FLT COND CLIMB HUMAN FACTORS VIB IN ALL AXIS COMPRESSION 265

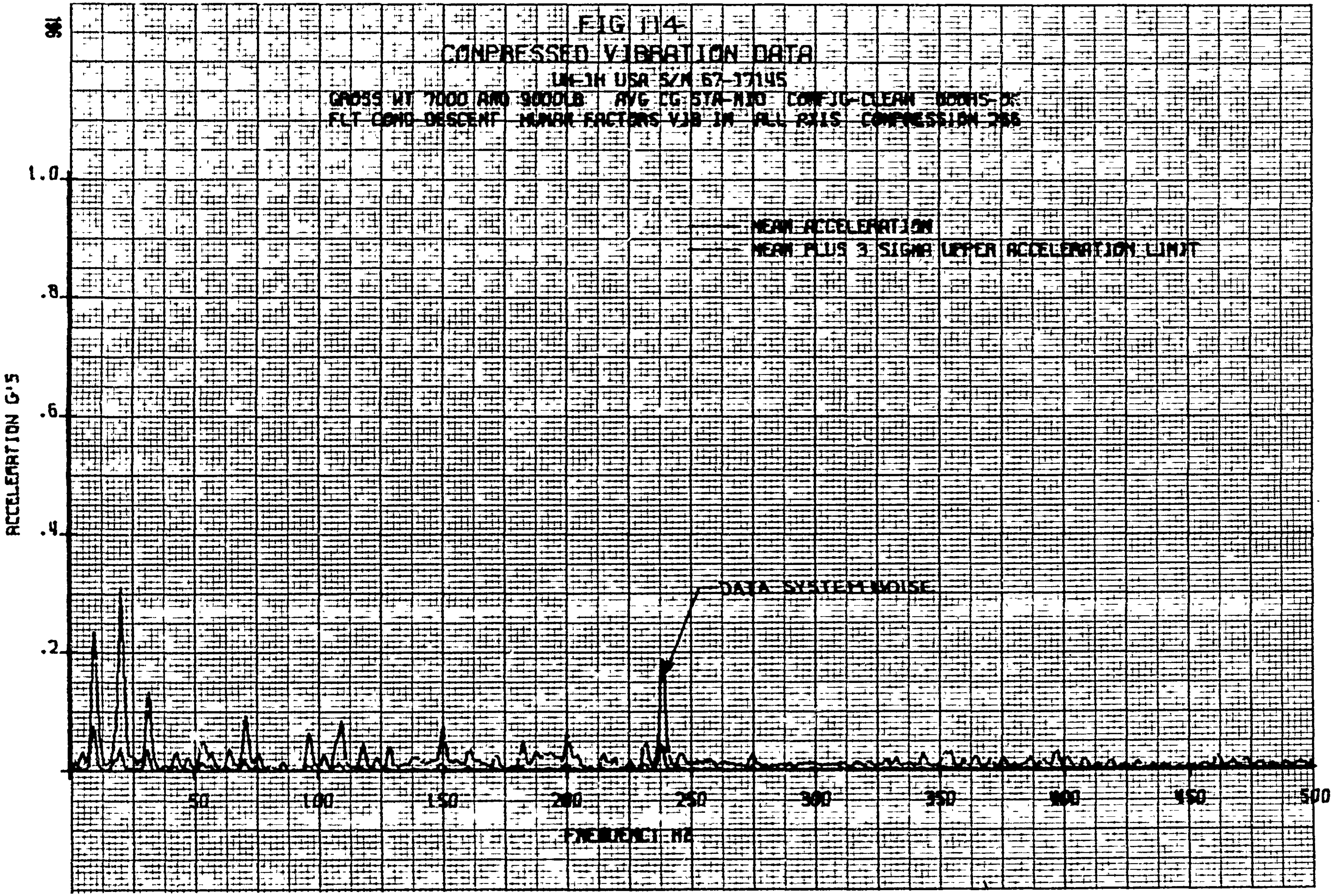


FIG 114
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-130 CONFIG-CLEAN DOORS-
FLT COND-DESCENT HUMAN FACTORS VIB IN ALL AXIS COMPRESSION 256
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

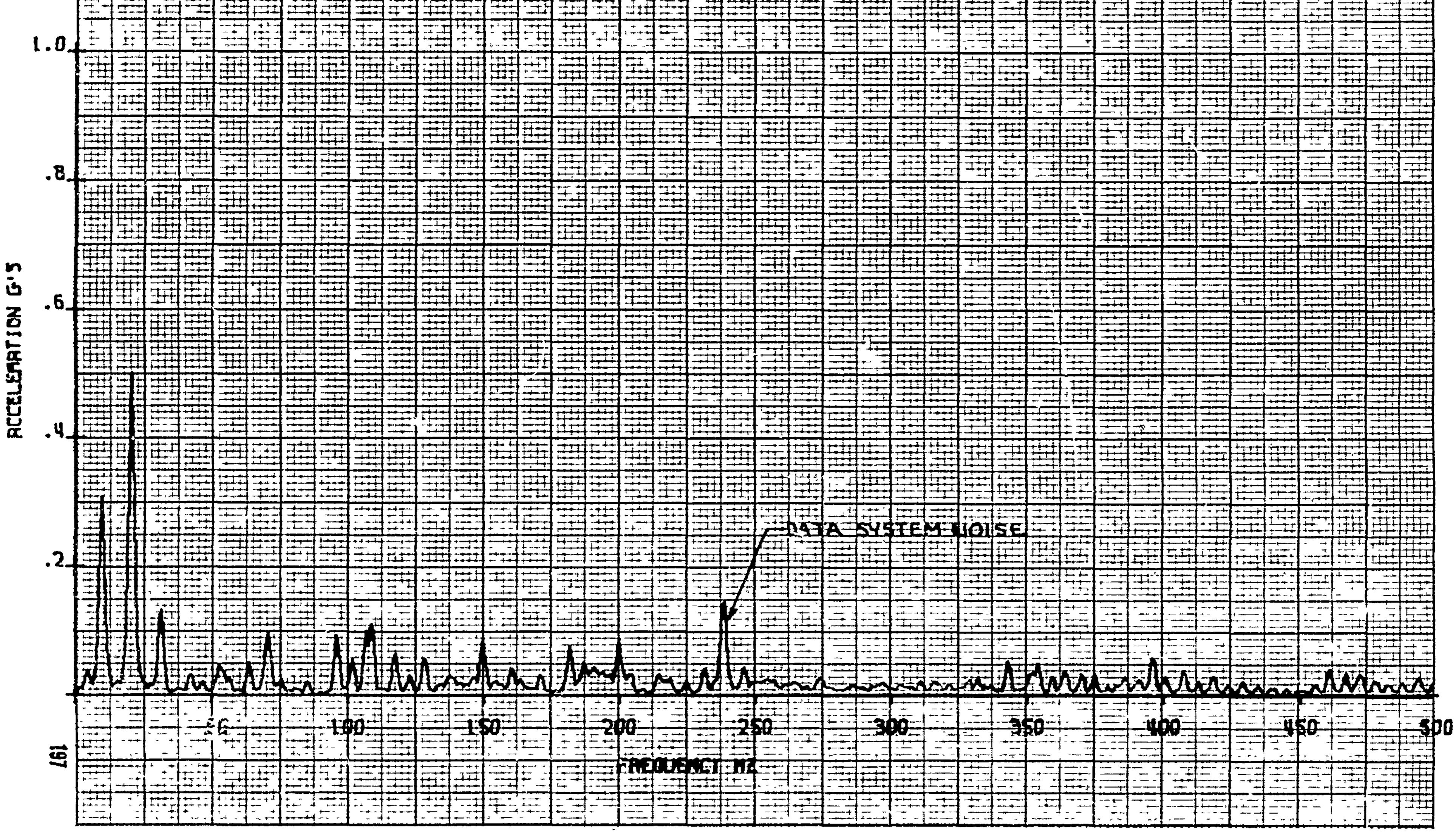


FIG 115
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND-DESCENT HUMAN FACTORS V30 IN ALL AXIS COMPRESSION 256

198

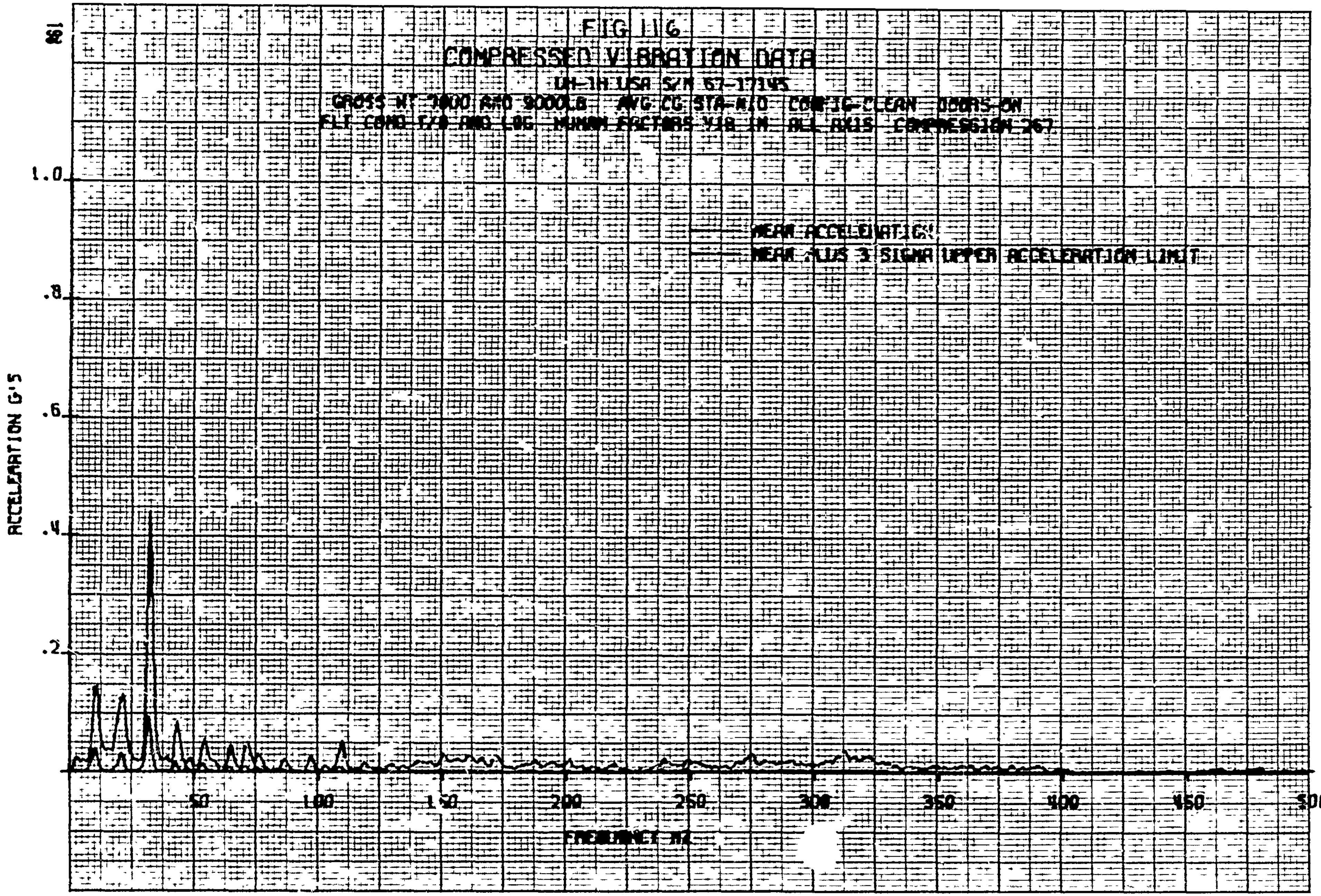


FIG 116
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND T/O AND LDG HUMAN FACTORS VIB IN ALL AXIS COMPRESSION 267
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

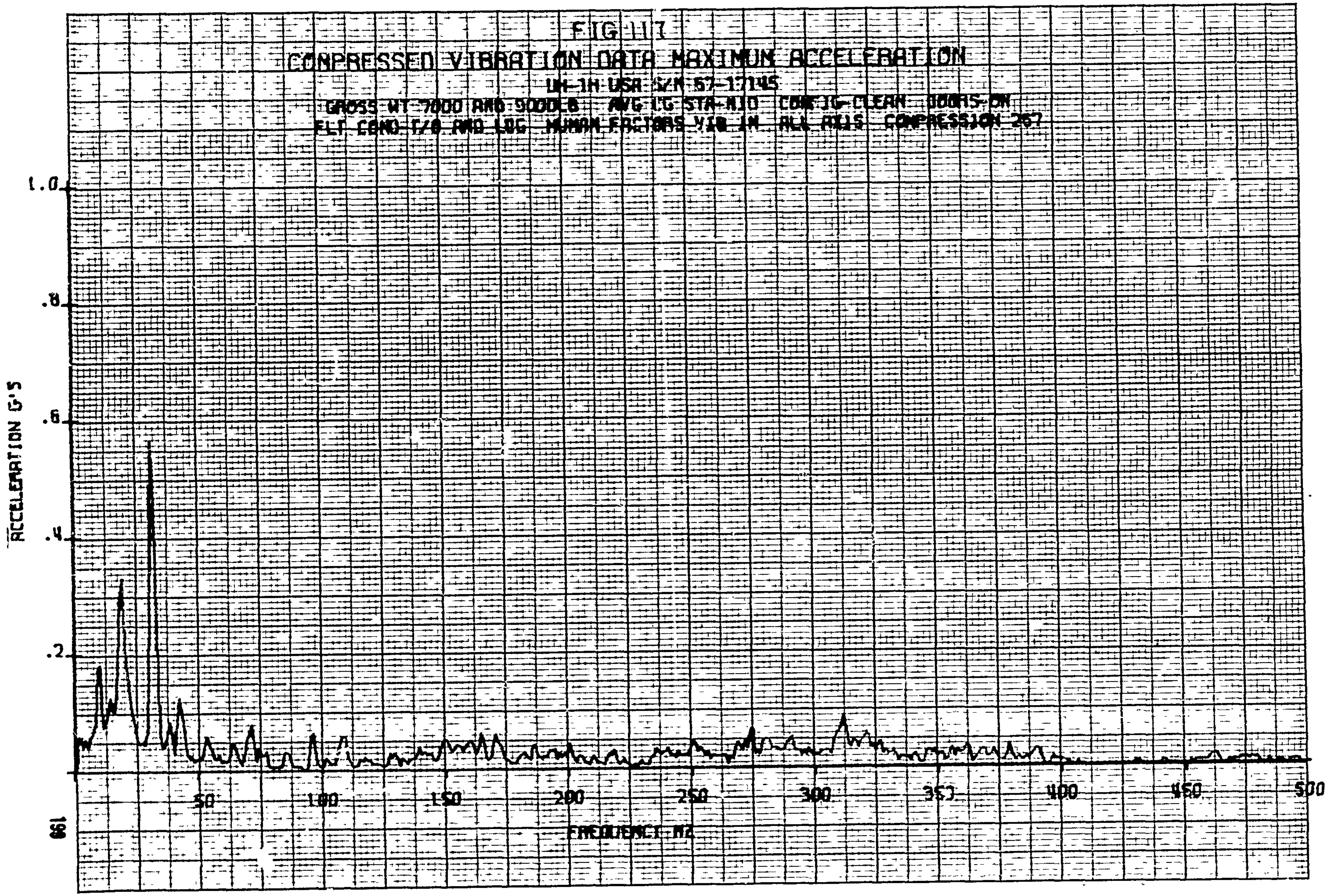


FIG 117
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB   AVG CG STA-MID   CONFIG-CLEAN   DOORS-ON
FLT COND T/O AND LDG   HUMAN FACTORS VIB IN   ALL AXIS   COMPRESSION 267
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

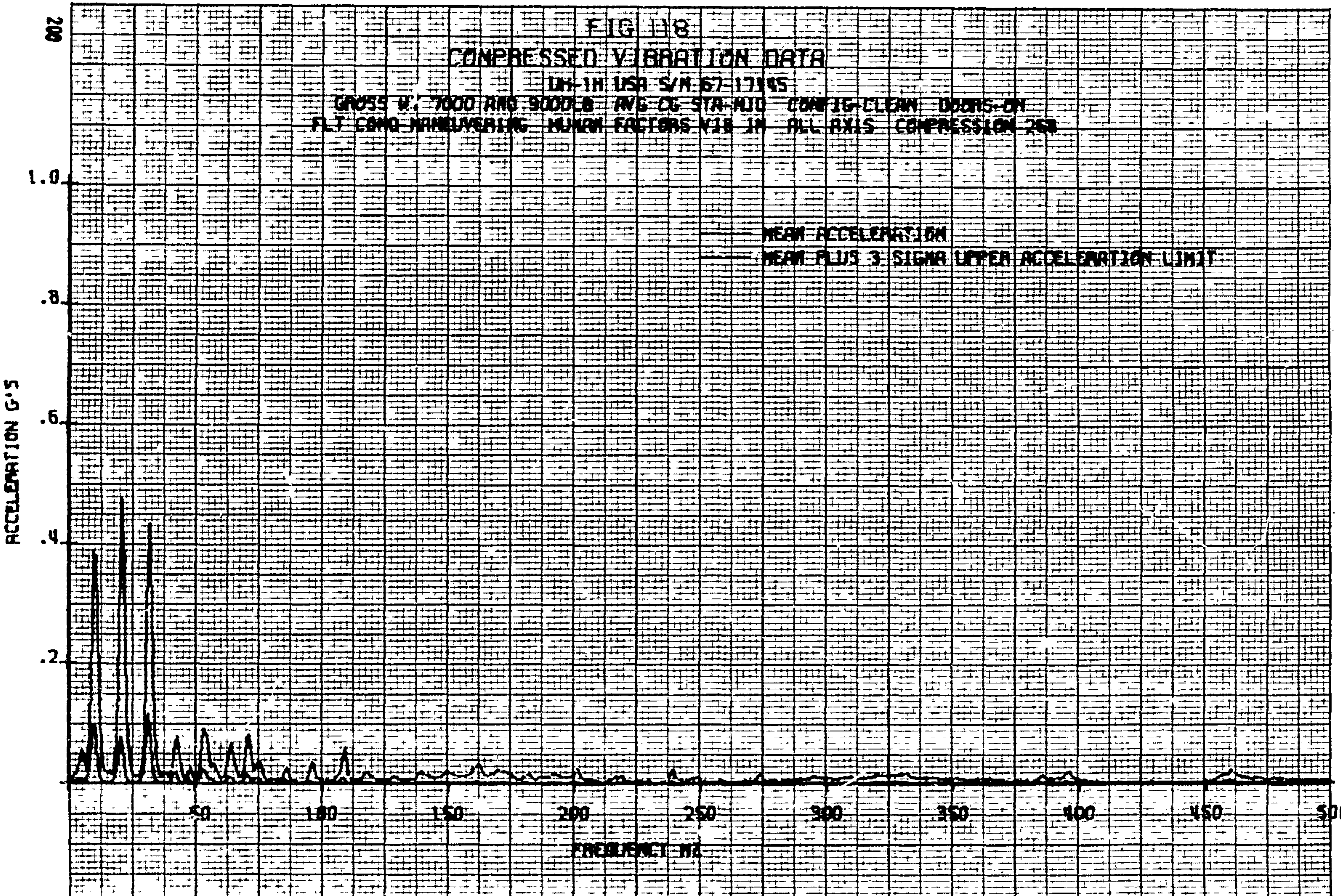


FIG 118
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS W. 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND MANEUVERING HUMAN FACTORS V18 1N ALL AXIS COMPRESSION 268
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

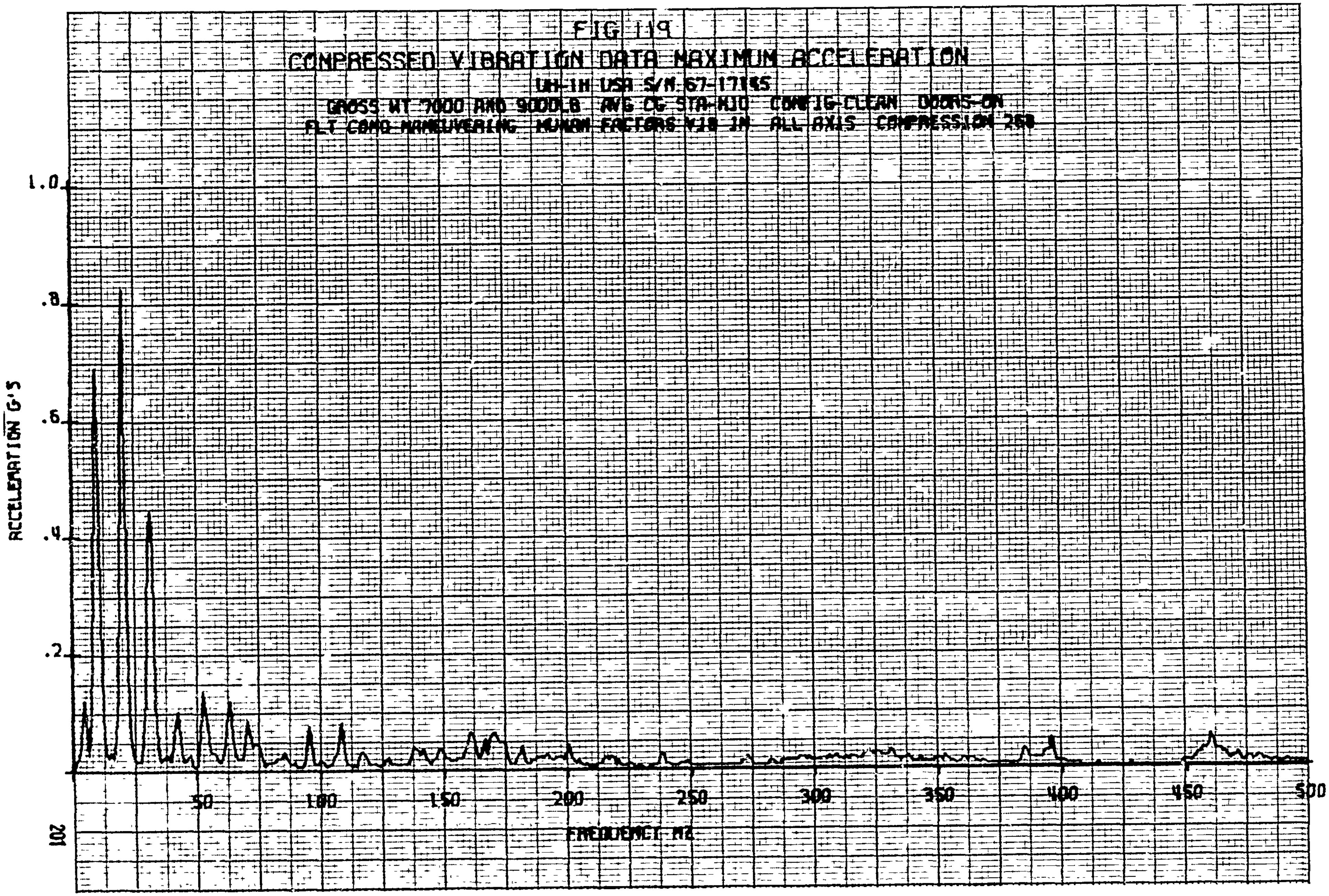


FIG 119
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND MANEUVERING HUMAN FACTORS V18 IN ALL AXIS COMPRESSION 260
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

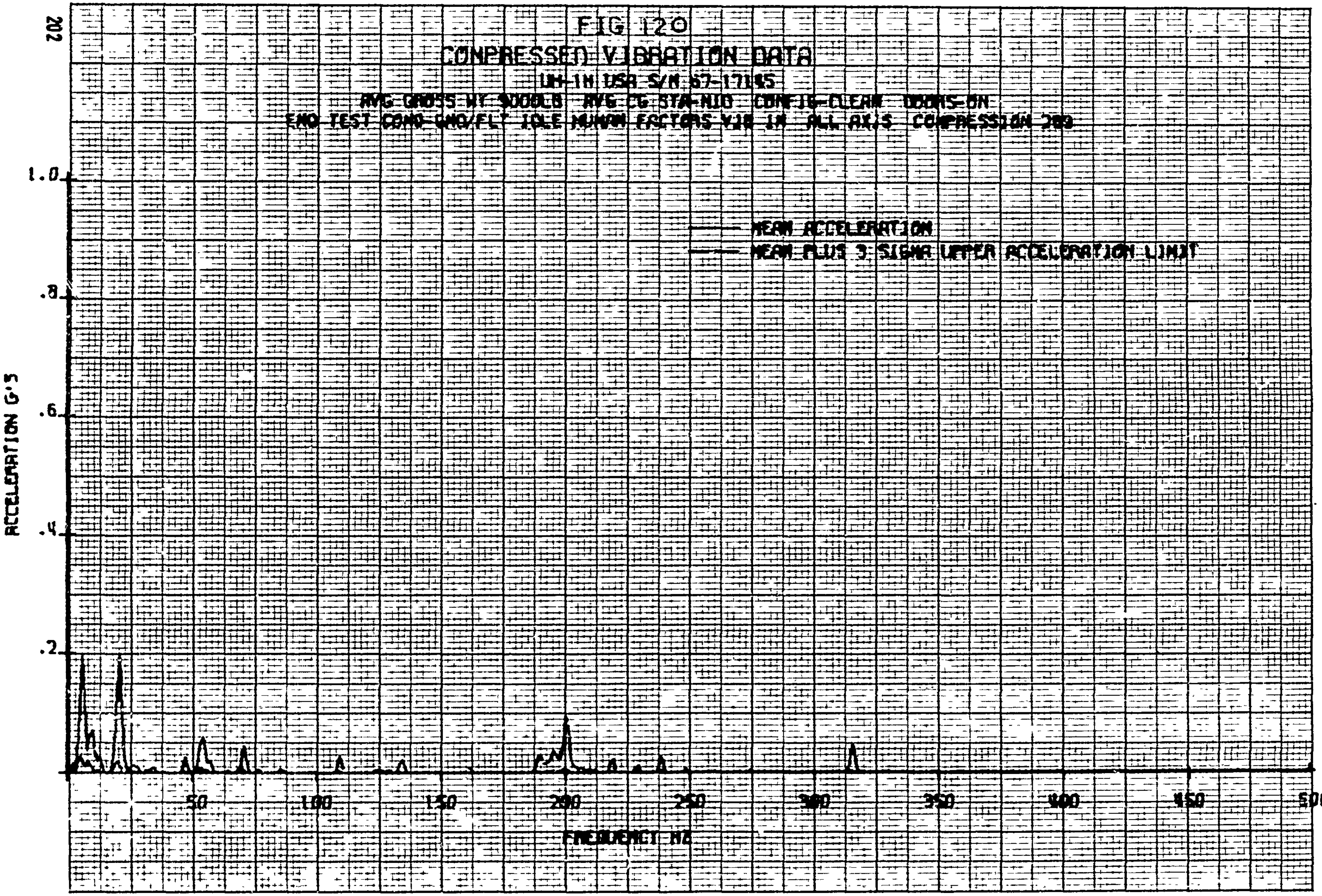


FIG 120
COMPRESSED VIBRATION DATA

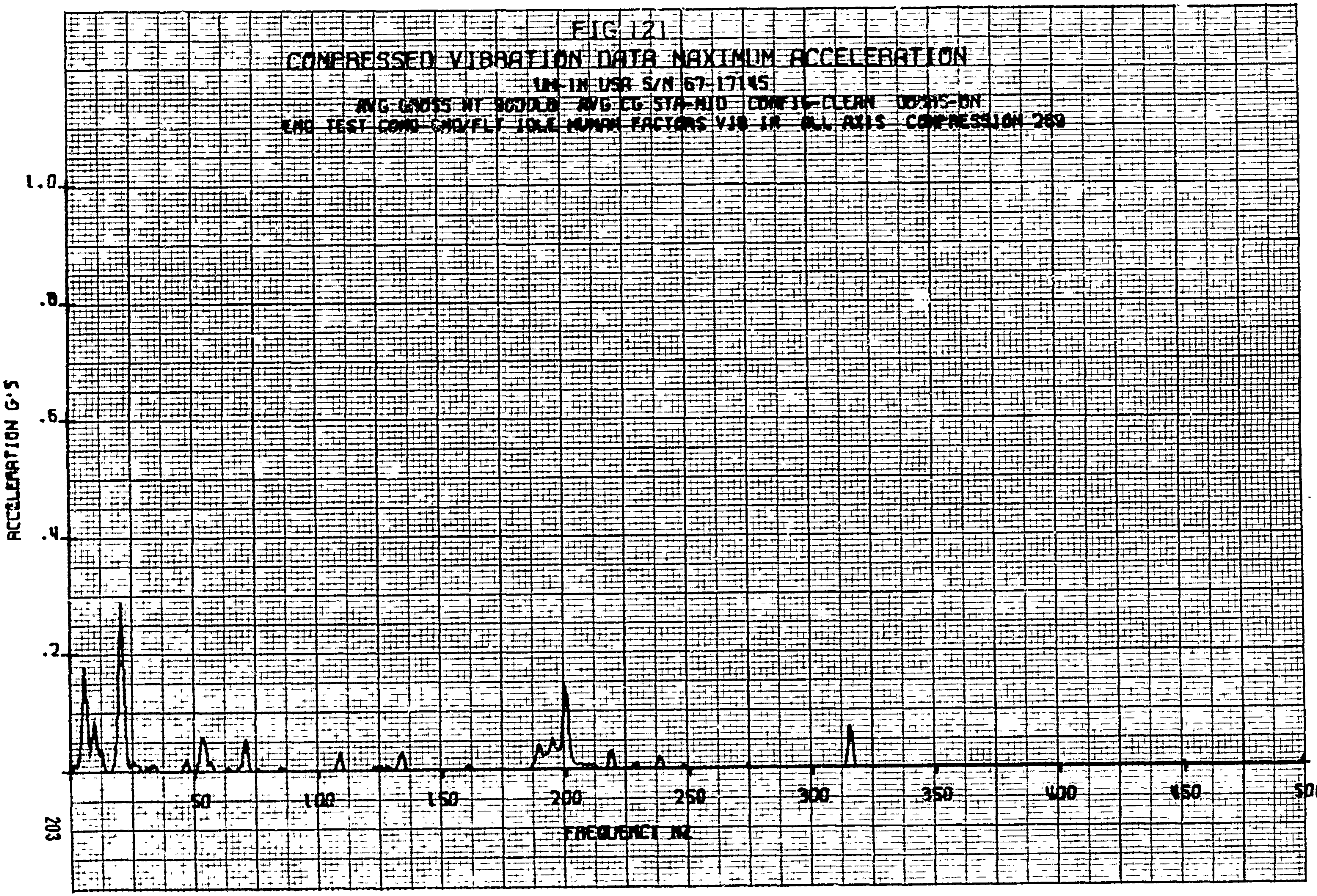


FIG 121
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

FIG 122
COMPRESSED VIBRATION DATA

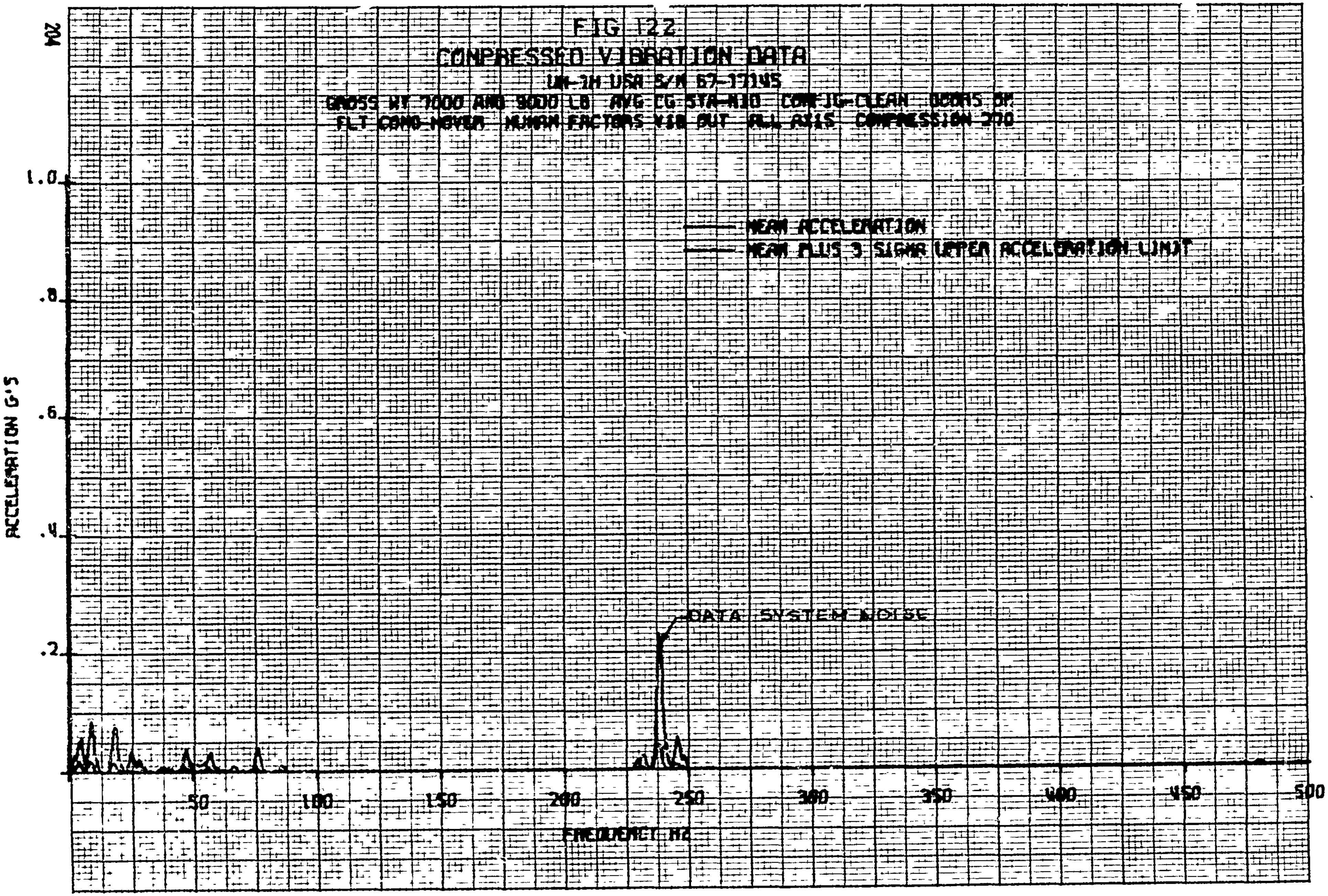


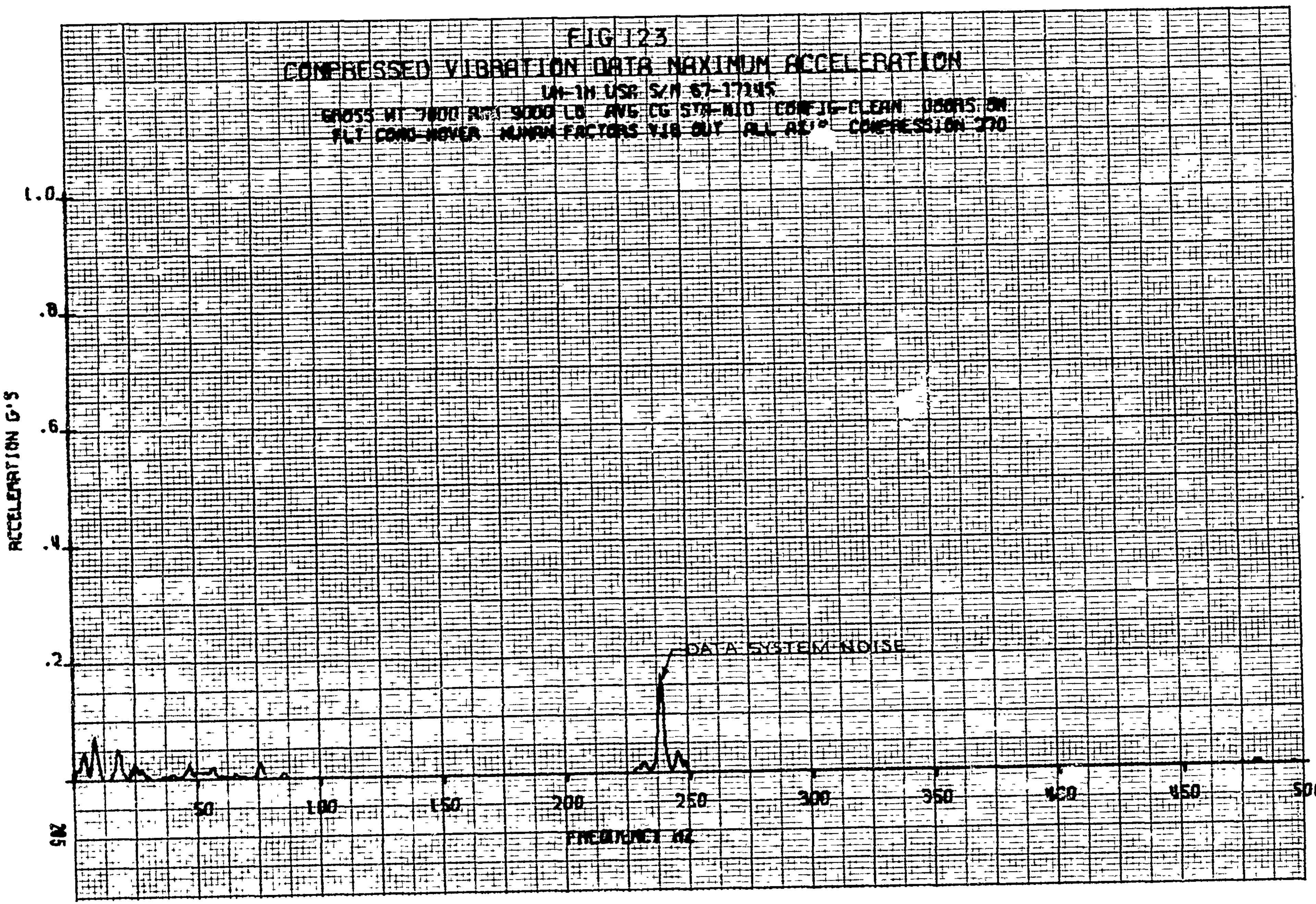
FIG 123

COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION

UH-1H USA S/N 67-17145

GROSS WT 7000 AND 9000 LB AVG CG STA-MID CONFIG-CLEAN DOORS ON

FLT COND-HOVER HUMAN FACTORS VIB OUT ALL AXIS COMPRESSION 270



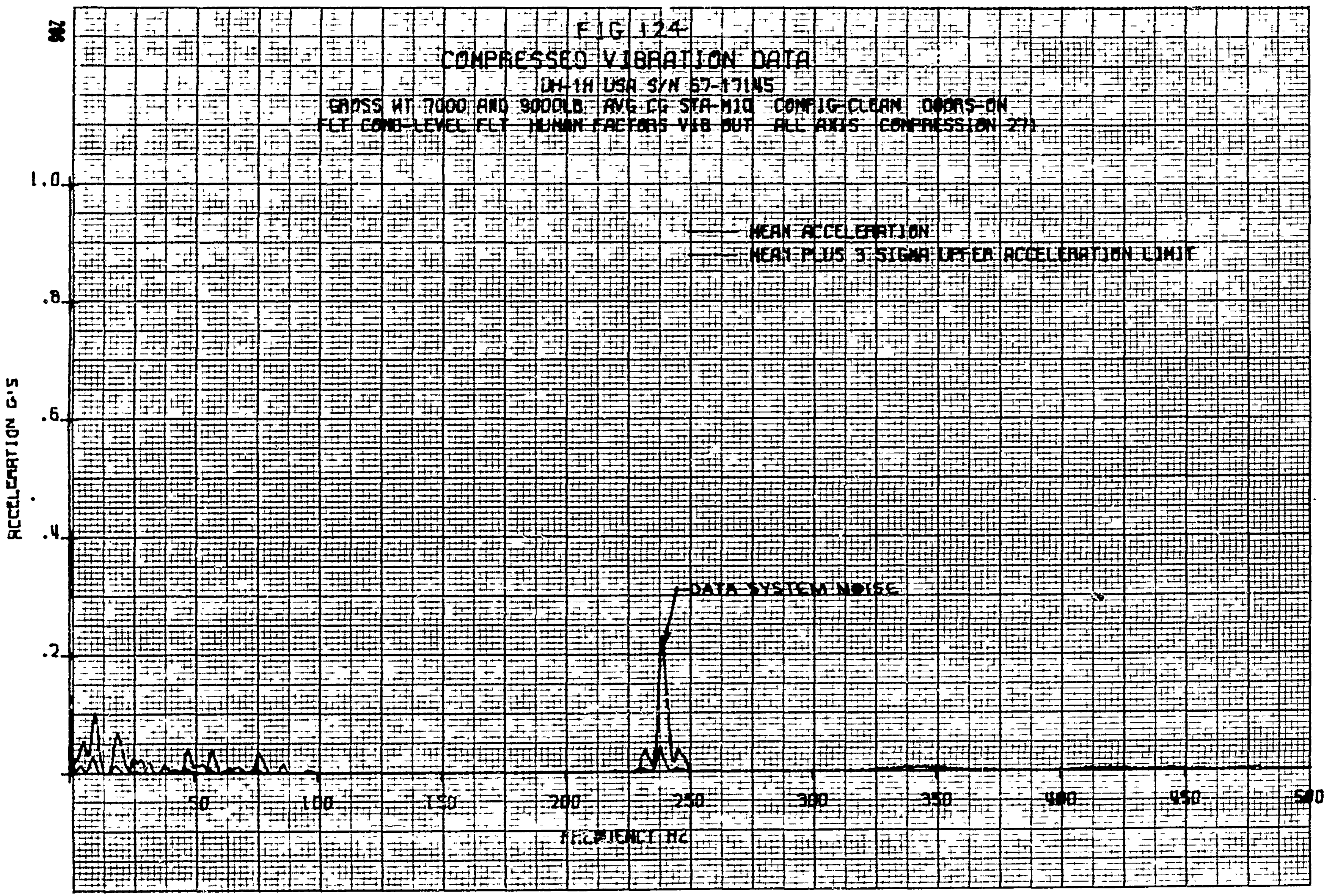


FIG 124
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-M10 CONFIG-CLEAN DOORS-ON
FLT COND-LEVEL FLT HUMAN FACTORS VIB OUT ALL AXIS COMPRESSION 271
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

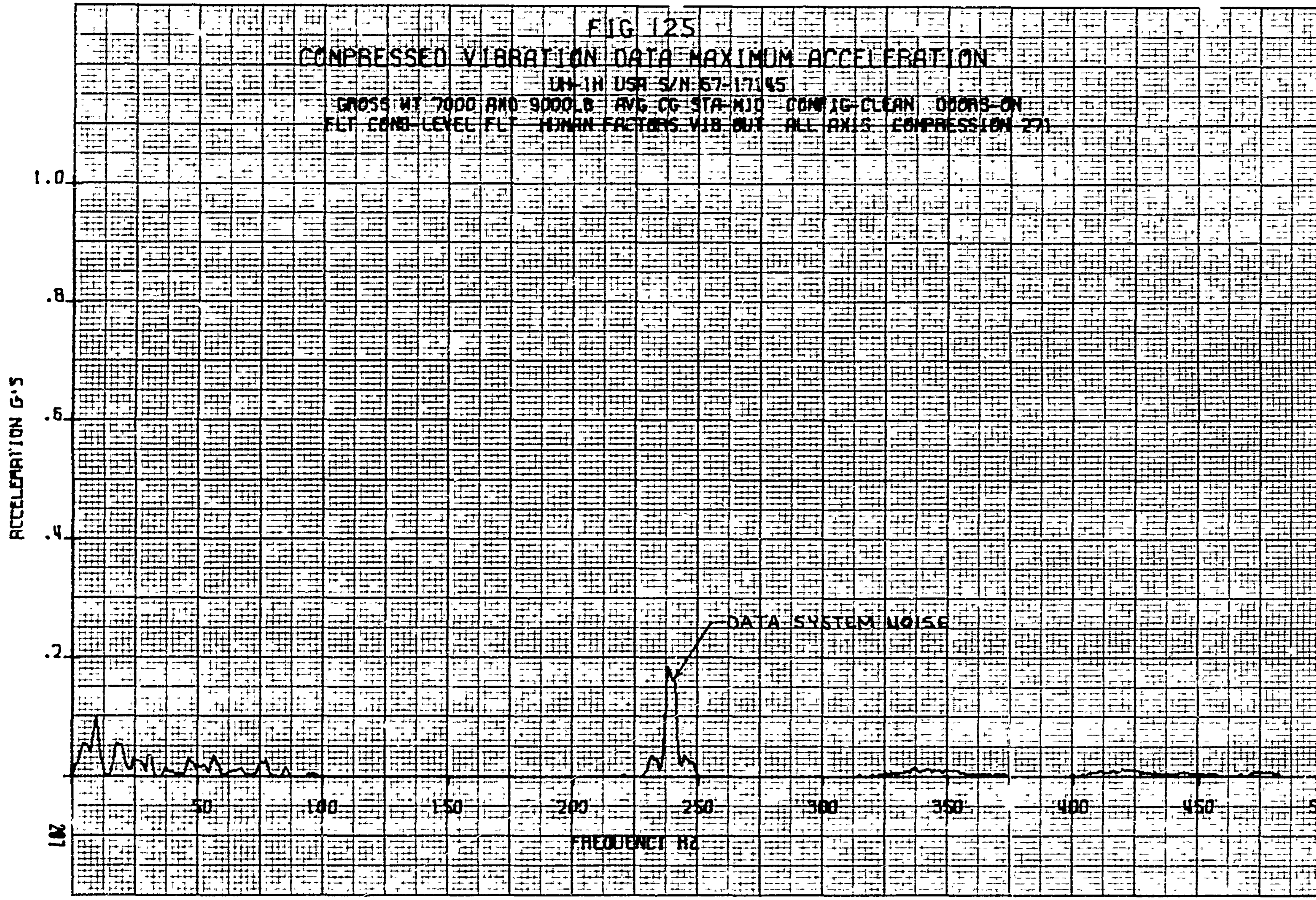


FIG 125
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND-LEVEL FLT HUMAN FACTORS VIB OUT ALL AXIS COMPRESSION 271

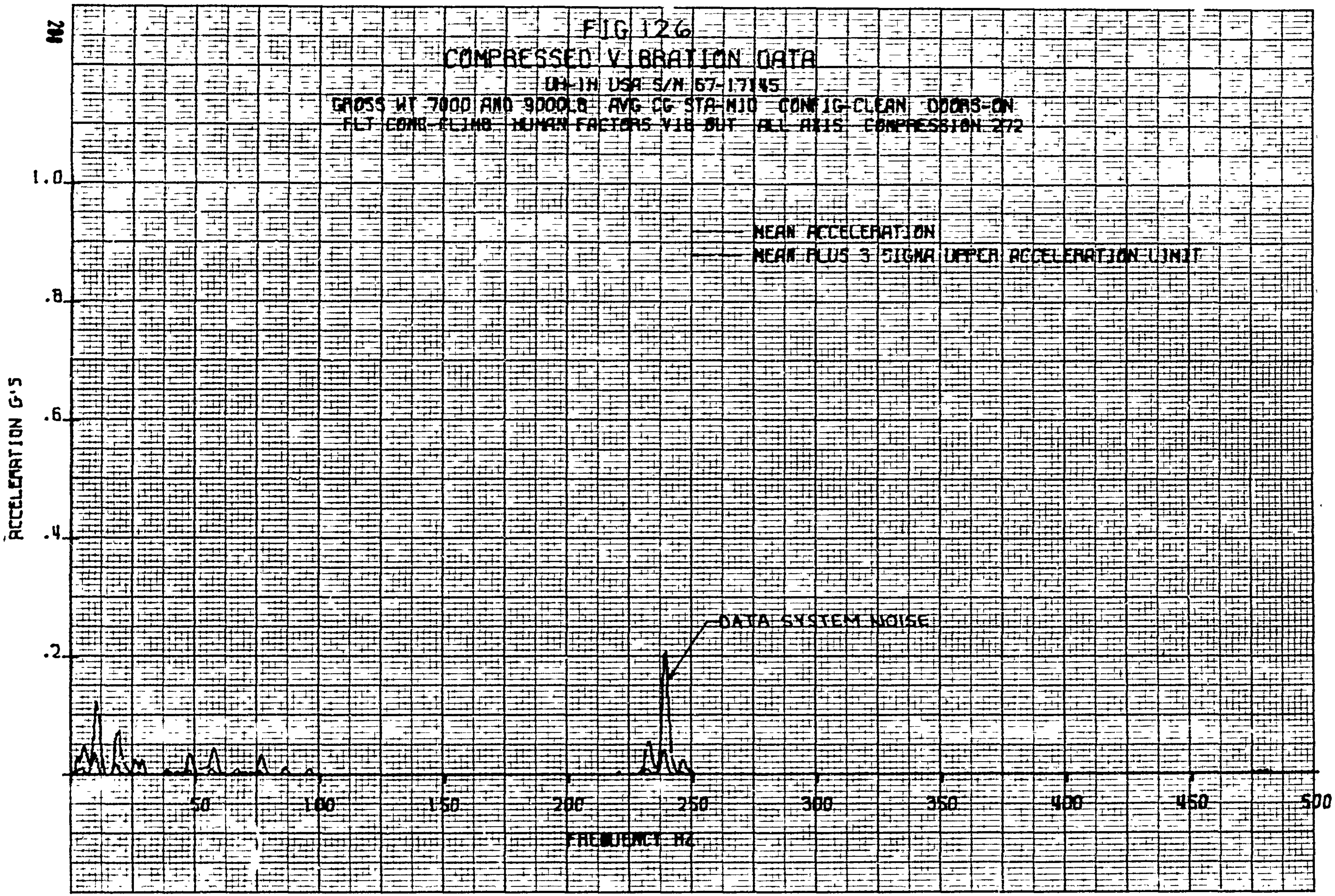


FIG 126
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND-CLIMB HUMAN FACTORS VIB OUT ALL AXIS COMPRESSION 272
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

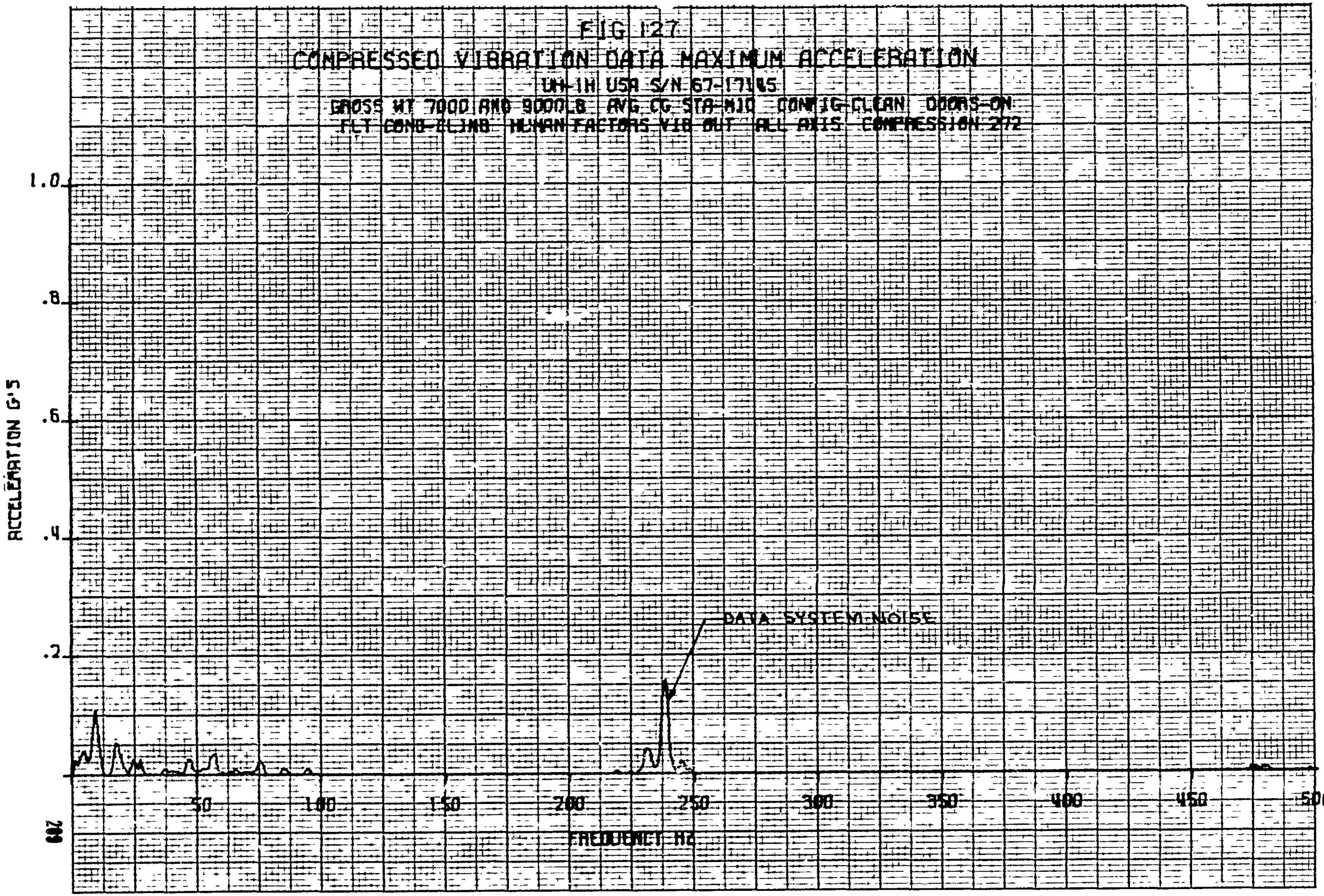


FIG 127
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND-CLIMB HUMAN FACTORS VIB OUT ALL AXIS COMPRESSION 272
DATA SYSTEM NOISE
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

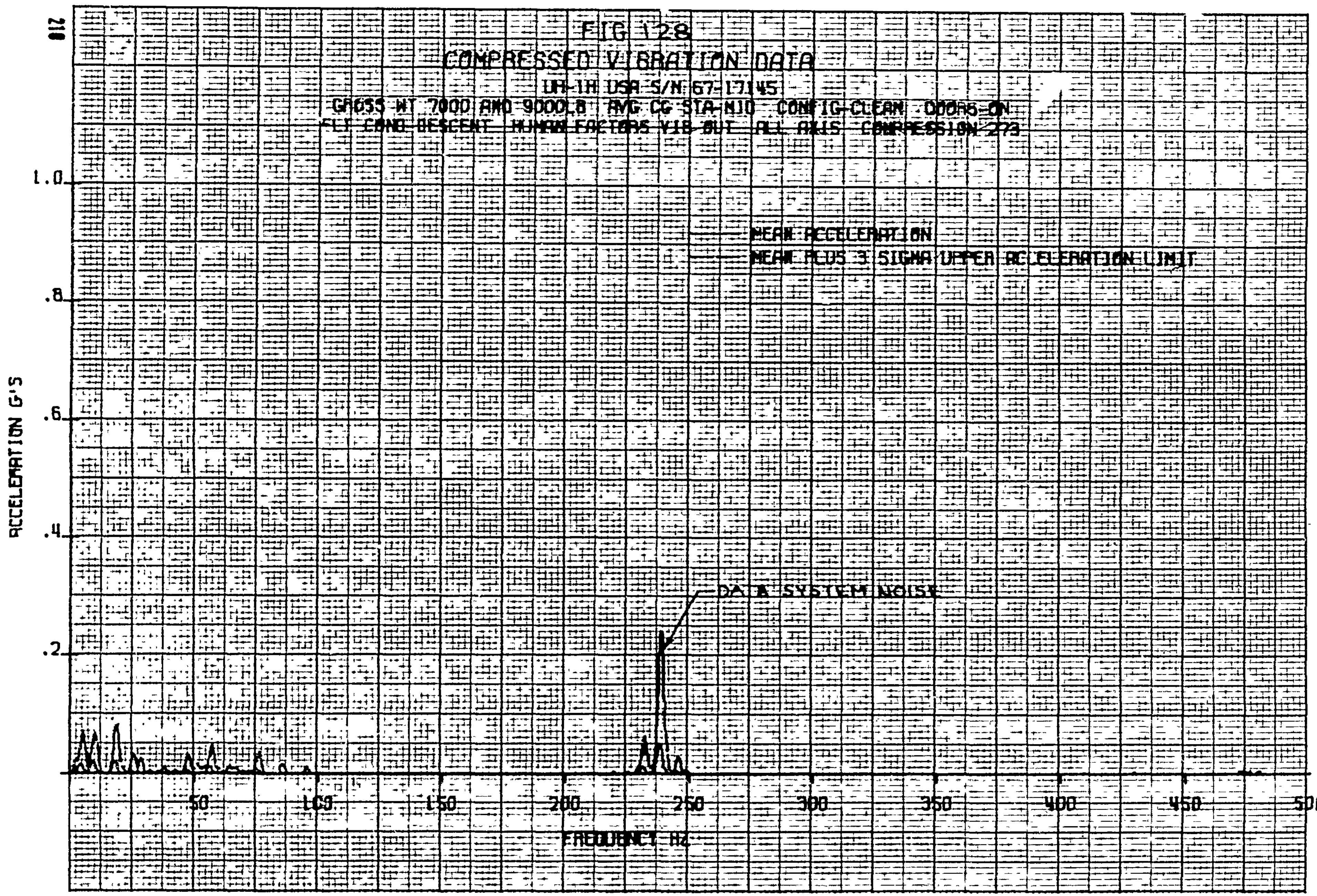


FIG 128
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND-DESCENT HUMAN FACTORS VIB OUT ALL AXIS COMPRESSION 273
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

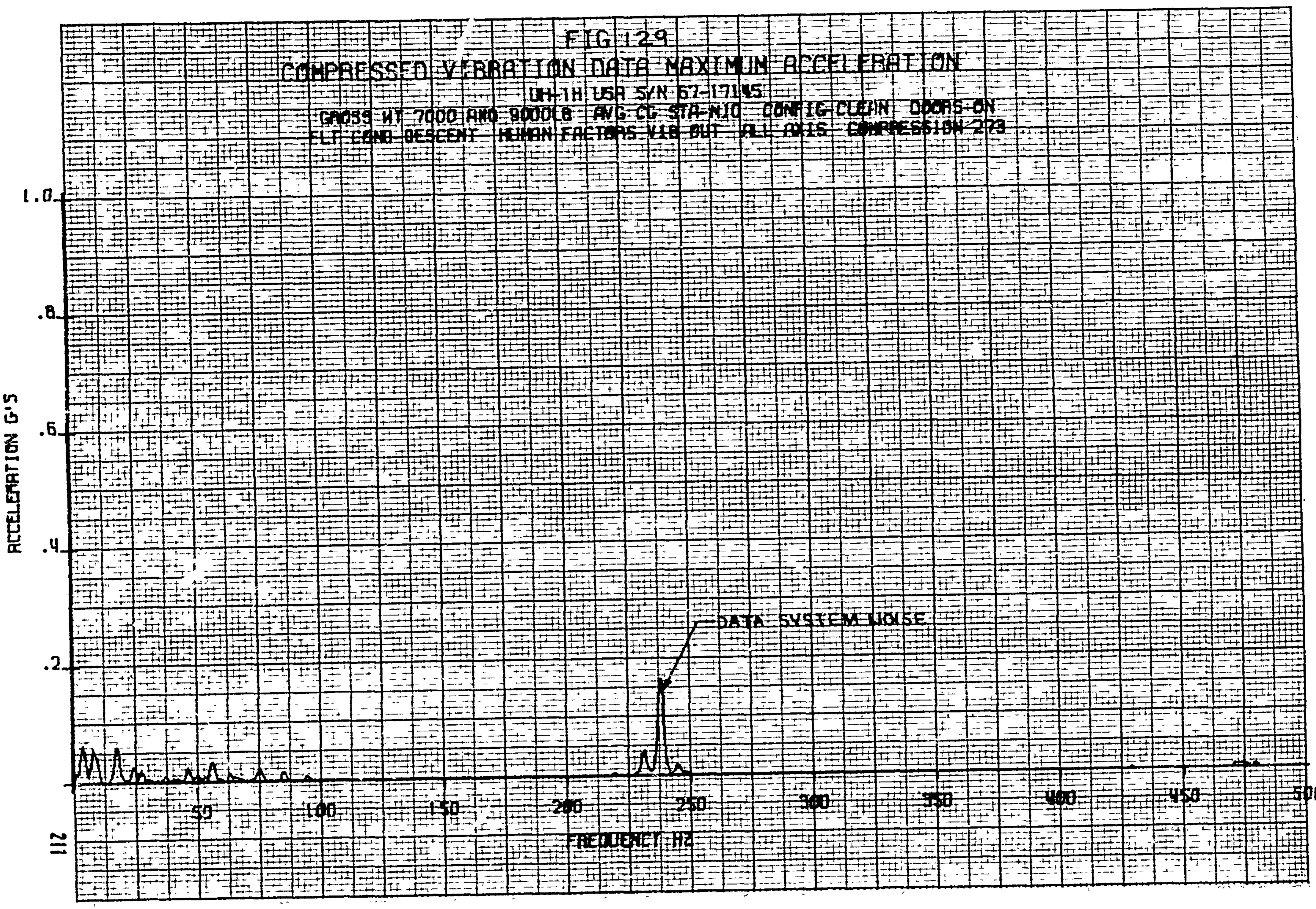


FIG 129
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND-DESCENT HUMAN FACTORS VIB OUT ALL AXIS COMPRESSION 273
ACCELERATION G'S
1.0
.8
.6
.4
.2
DATA SYSTEM NOISE
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

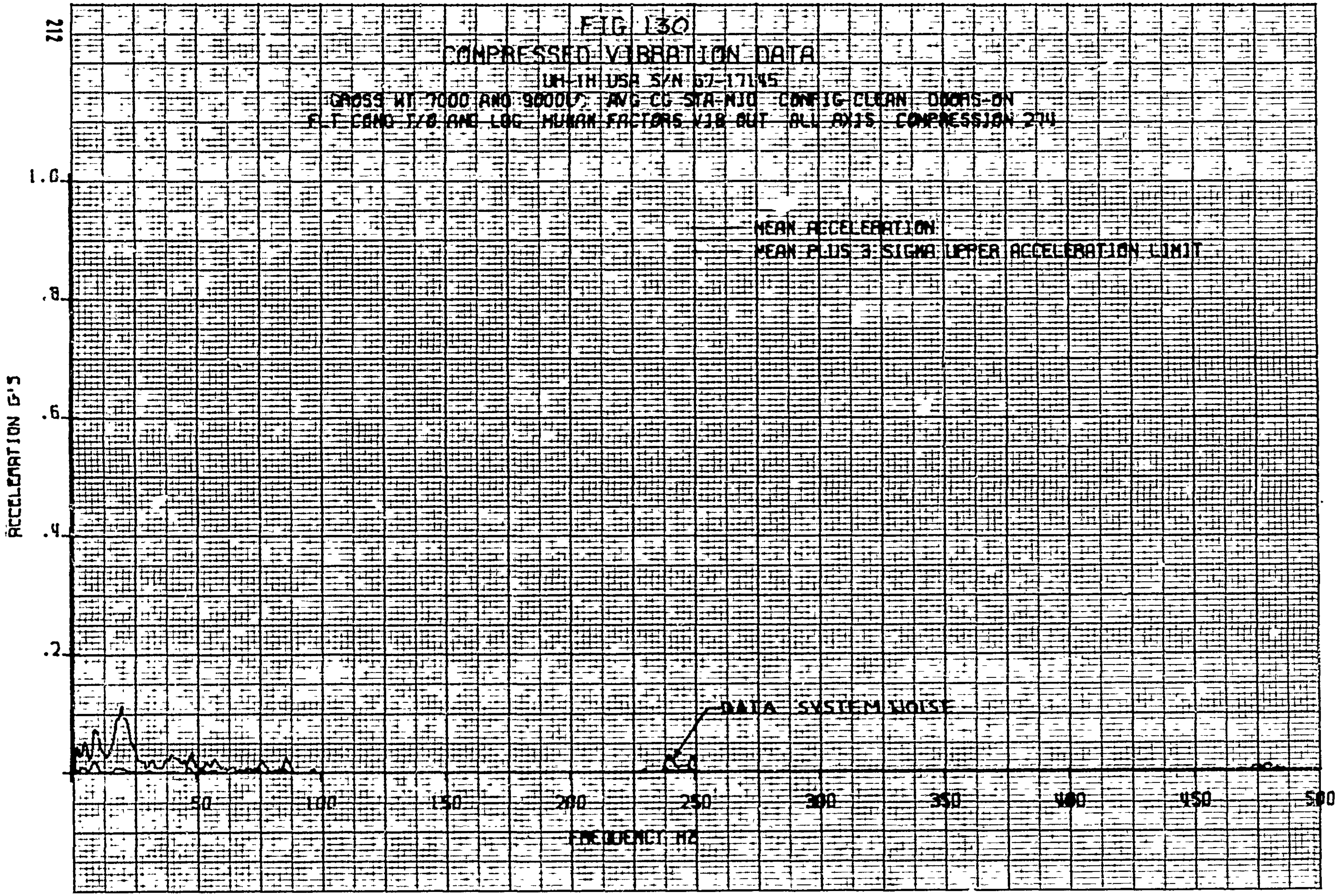


FIG 130
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000 AVG CG STA-MID CONFIG CLEAN DOORS-ON
FLT COND I/O AND LOG HUMAN FACTORS V18 OUT ALL AXIS COMPRESSION 2.4
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

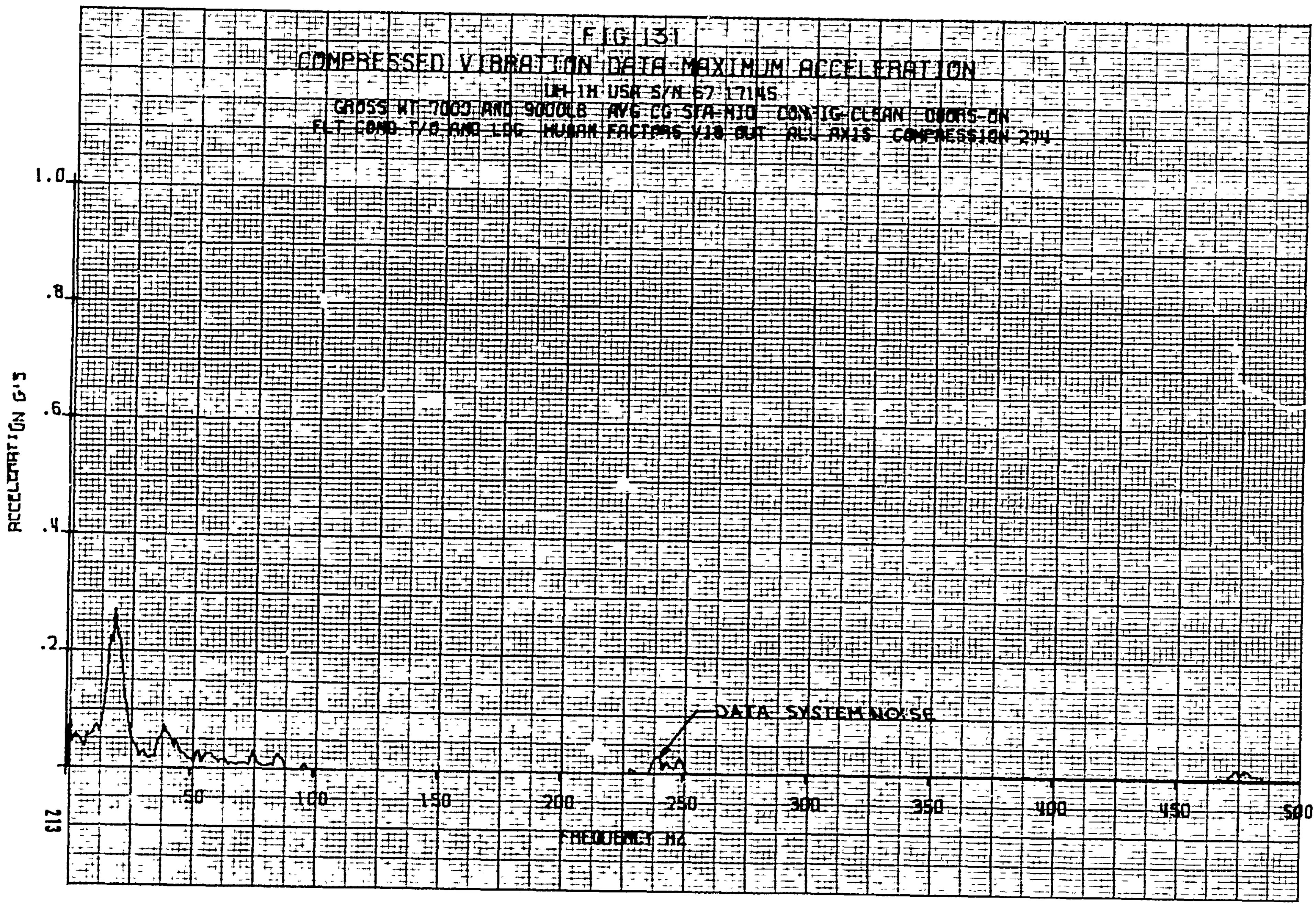


FIG 131
COMPRESSED VIBRATION DATA-MAXIMUM ACCELERATION
UH-1H USA S/N 67 17145
GROSS WT 7000 AND 9000LB AVG CG STA-N10 CONFIG-CLEAN DOORS-ON
FLT COND T/O AND LDG HUMAN FACTORS V18 OUT ALL AXIS COMPRESSION 2?4
1.0
.8
.6
.4
.2
ACCELERATION G'S
DATA SYSTEM NOISE
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

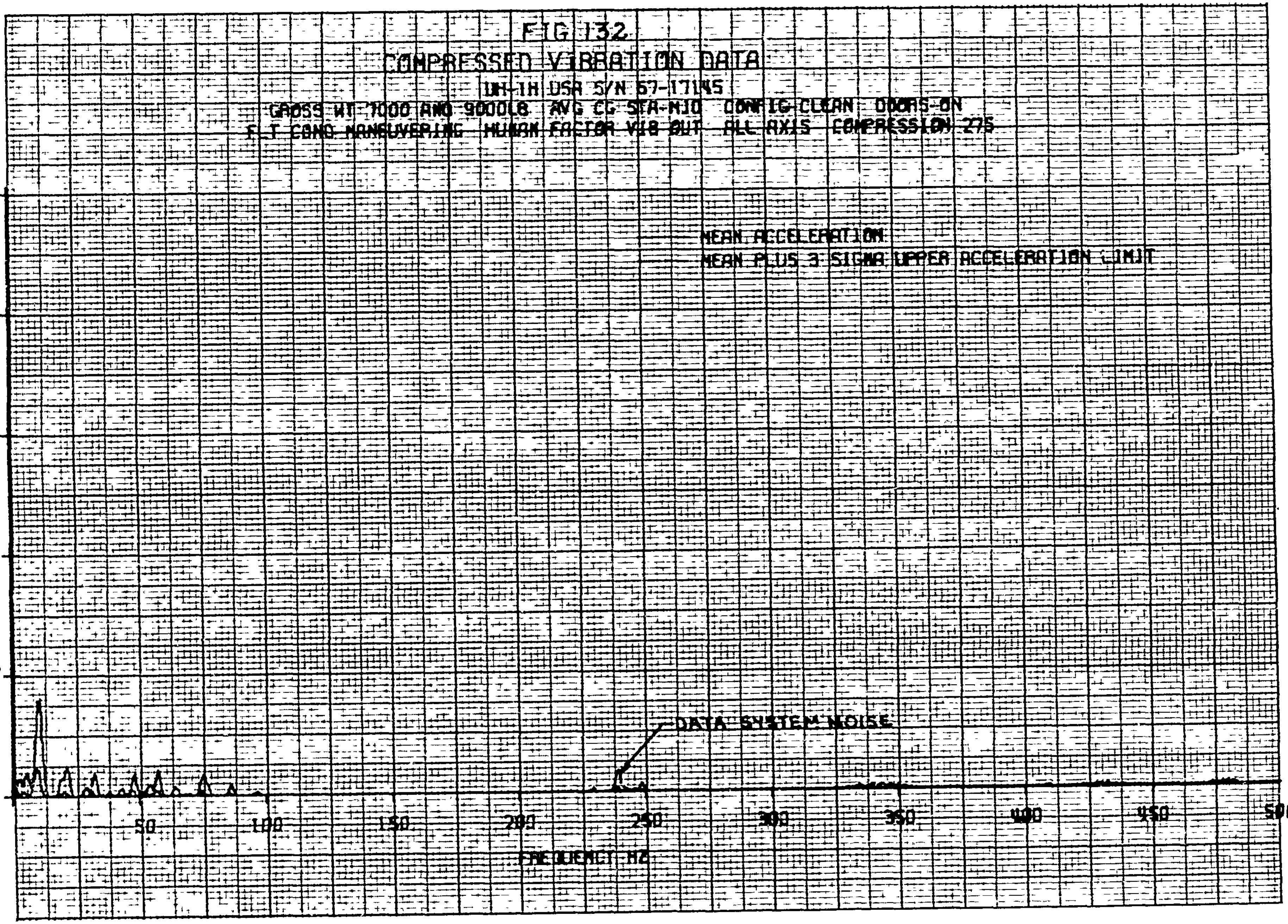


FIG 132
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-H10 CONFIG-CLEAN DOORS-ON
FLT COND MANEUVERING HUMAN FACTOR VIB OUT ALL AXIS COMPRESSION 275
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

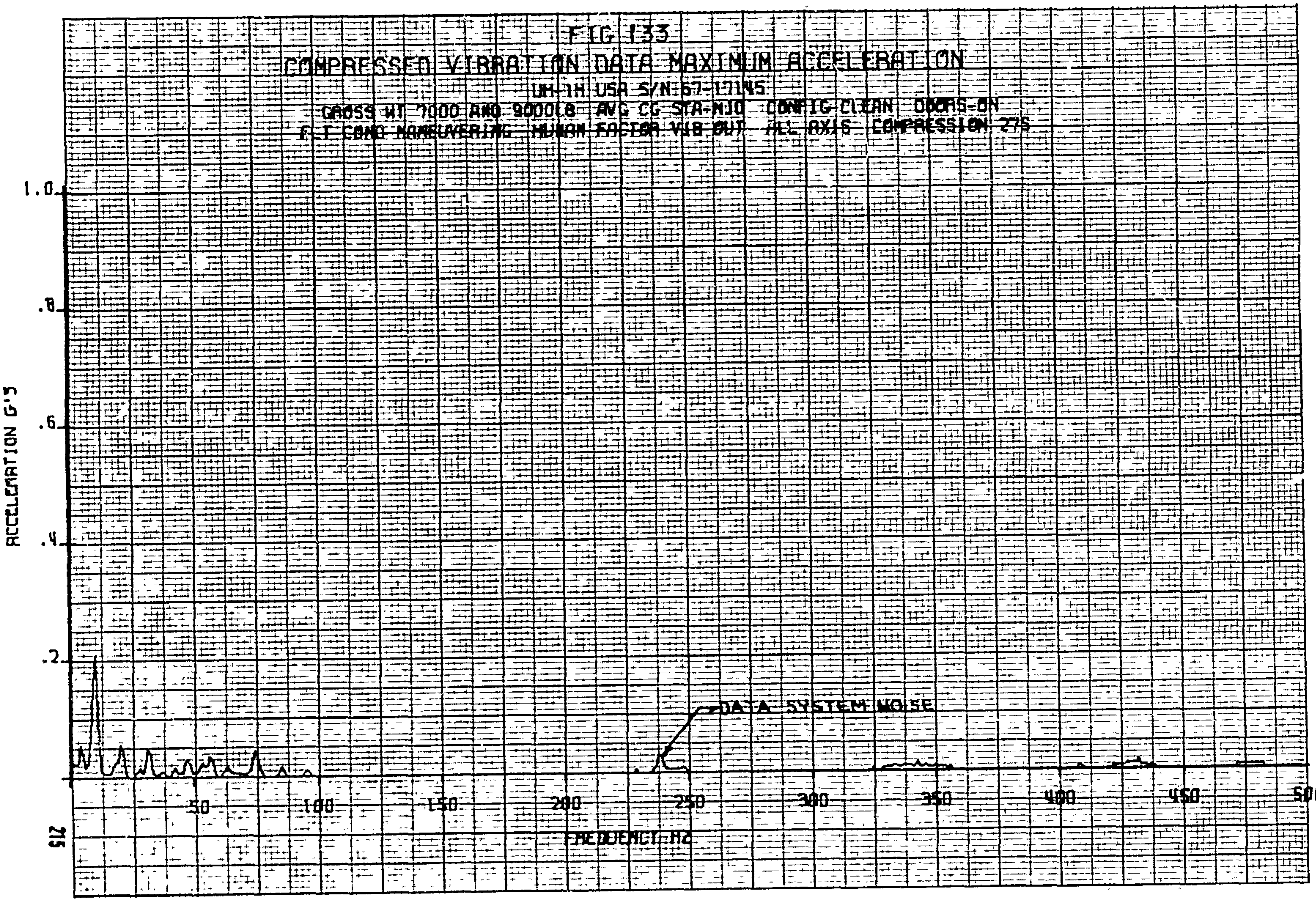


FIG 133
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
GROSS WT 7000 AND 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
FLT COND MANEUVERING HUMAN FACTOR VIB OUT ALL AXIS COMPRESSION 275
ACCELERATION G'S
1.0
.8
.6
.4
.2
DATA SYSTEM NOISE
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

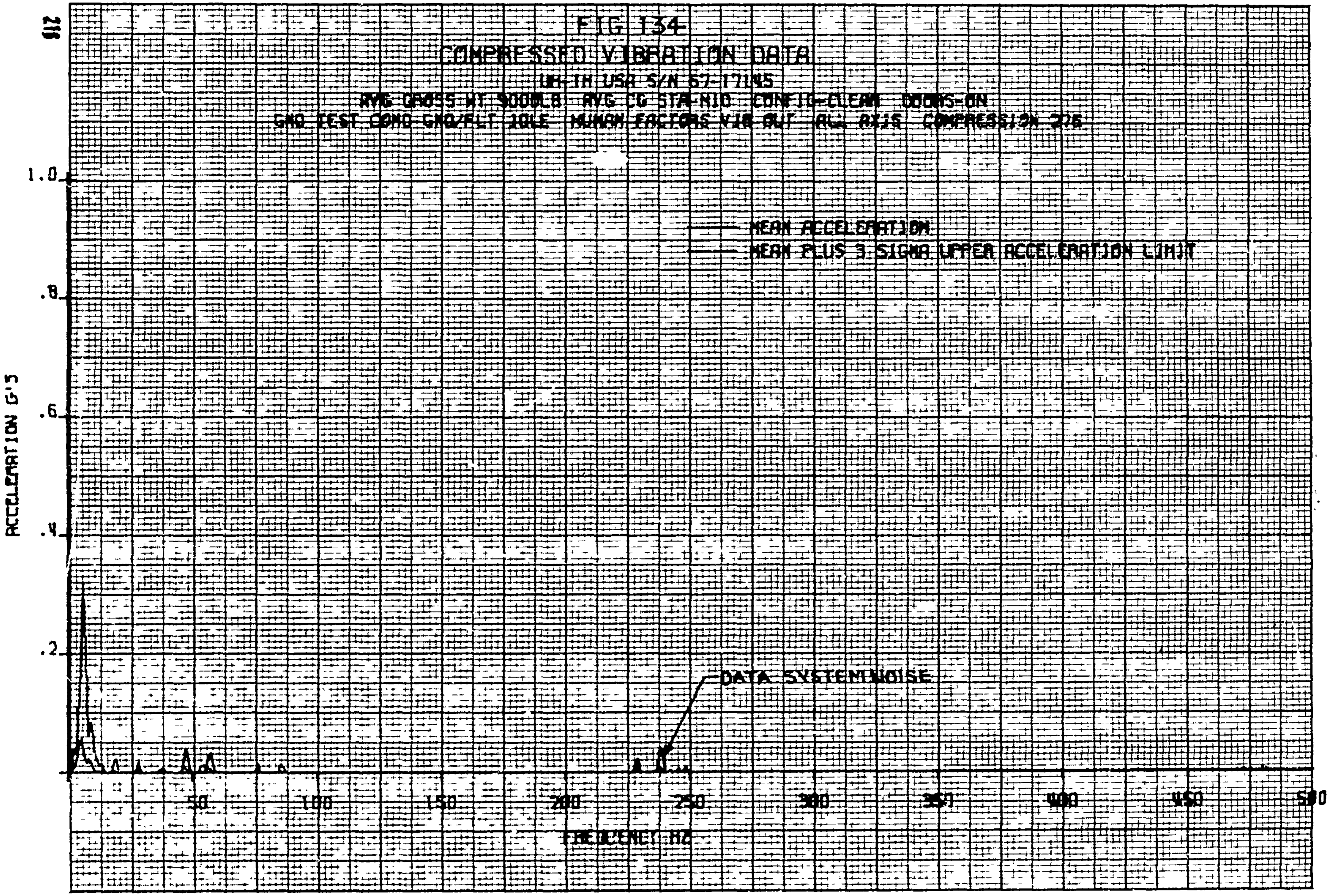


FIG 134
COMPRESSED VIBRATION DATA
UH-1H USA S/N 67-17145
AVG GROSS WT 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
GND TEST COND-GND/FLT IDLE HUMAN FACTORS VIB OUT AL. AXIS COMPRESSION 226
MEAN ACCELERATION
MEAN PLUS 3 SIGMA UPPER ACCELERATION LIMIT
DATA SYSTEM NOISE
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

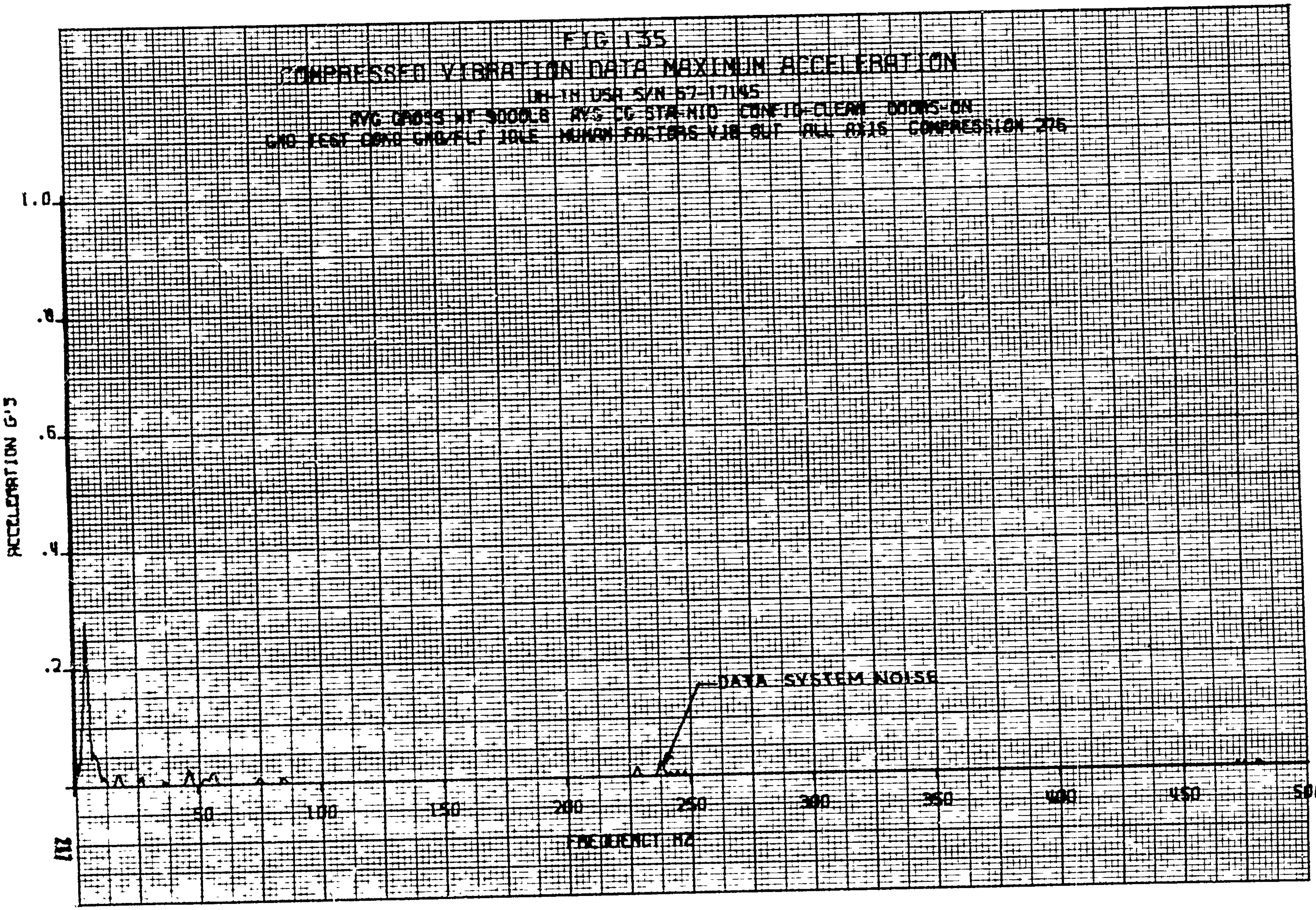


FIG 135
COMPRESSED VIBRATION DATA MAXIMUM ACCELERATION
UH-1H USA S/N 67-17145
AVG GROSS WT 9000LB AVG CG STA-MID CONFIG-CLEAN DOORS-ON
GND TEST COND GND/FLT IDLE HUMAN FACTORS VIB OUT ALL AXIS COMPRESSION 276
DATA SYSTEM NOISE
ACCELERATION G'S
1.0
.8
.6
.4
.2
50
100
150
200
250
300
350
400
450
500
FREQUENCY HZ

FIGURE 136
STATIC INTERIOR TEMPERATURE
UH-1H USA S/N67-17145
FORWARD AVIONICS

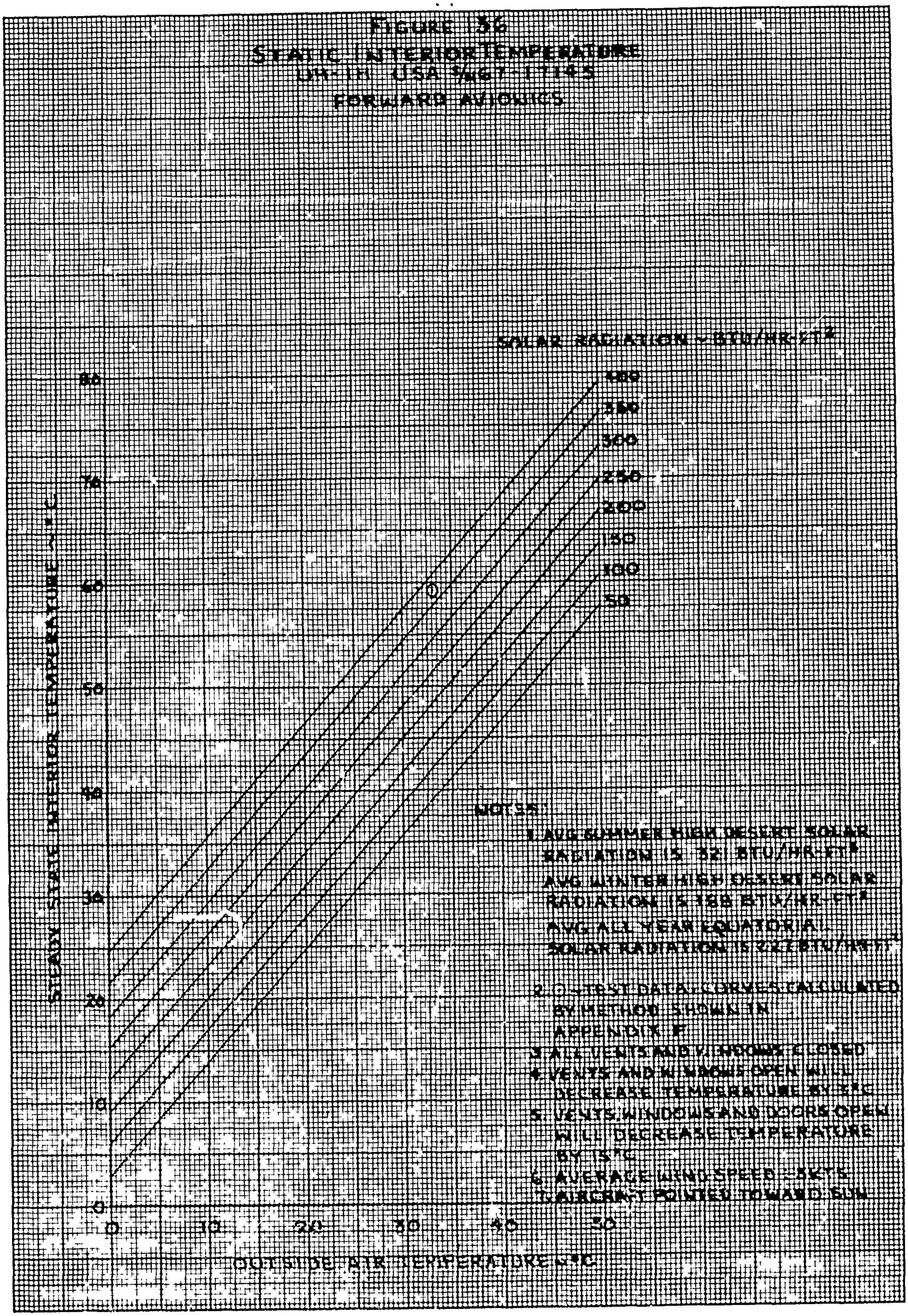
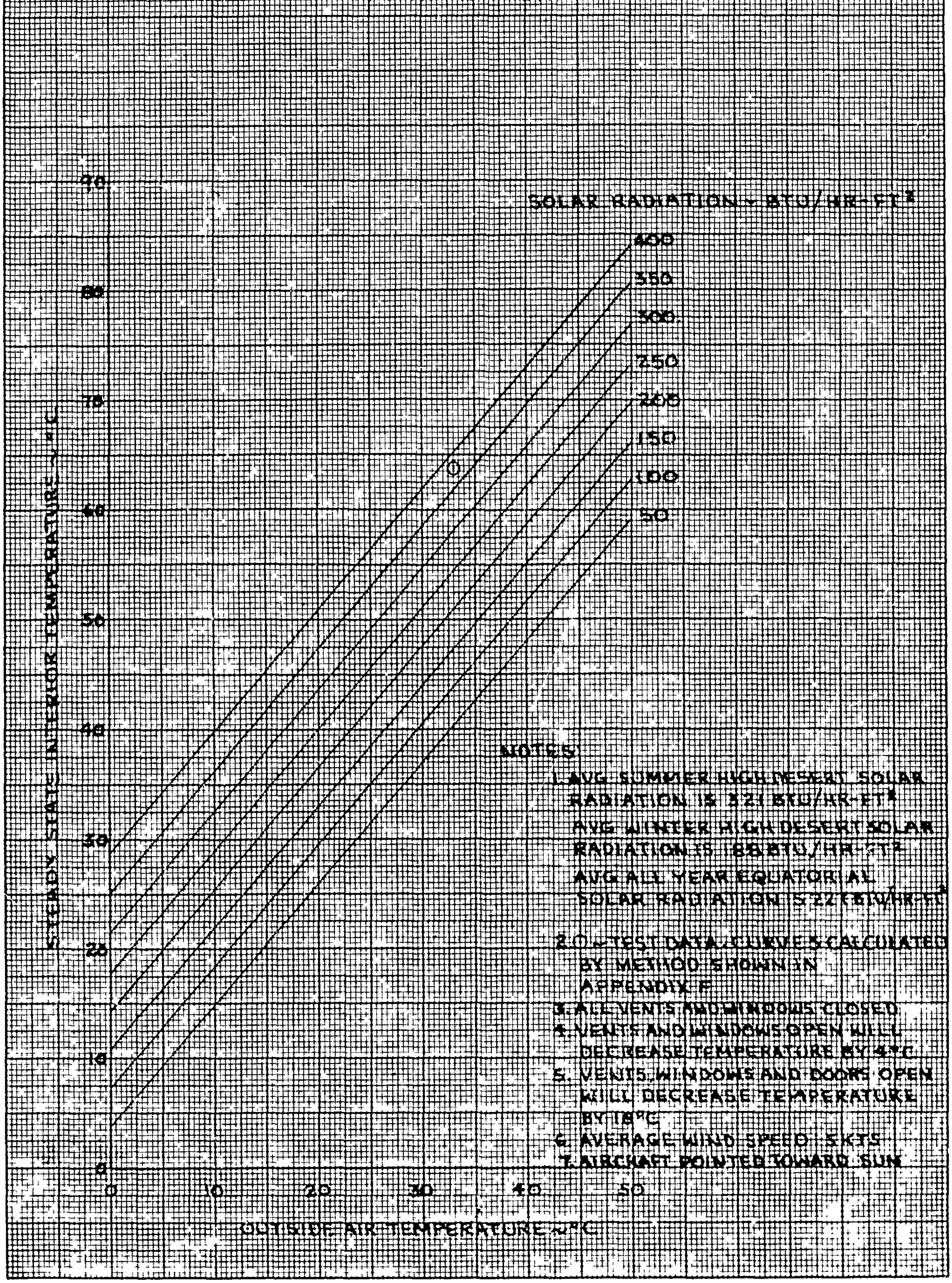


FIGURE 137
STATIC INTERIOR TEMPERATURE
UH-1H USA S/N 67-17145
FORWARD CABIN



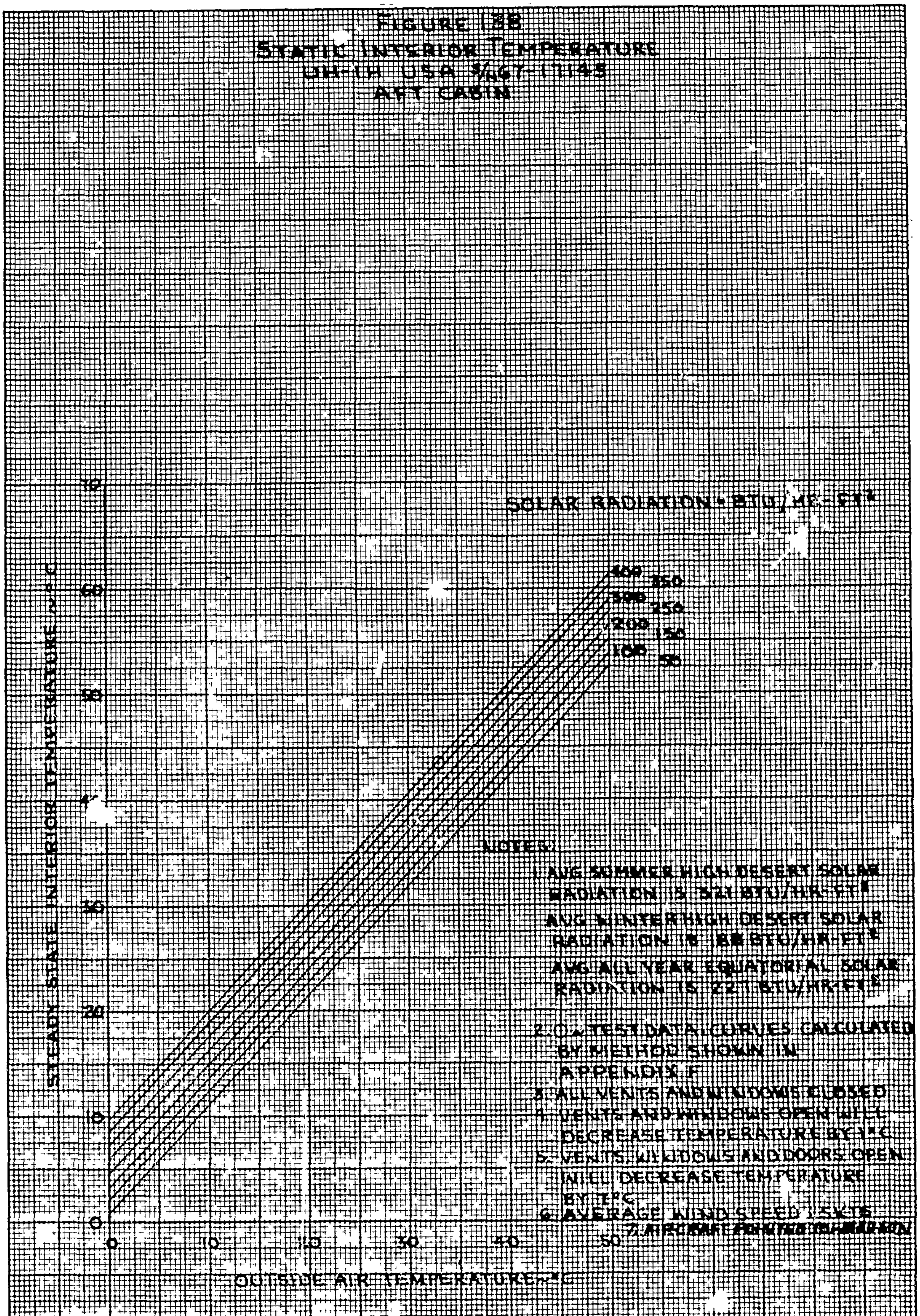
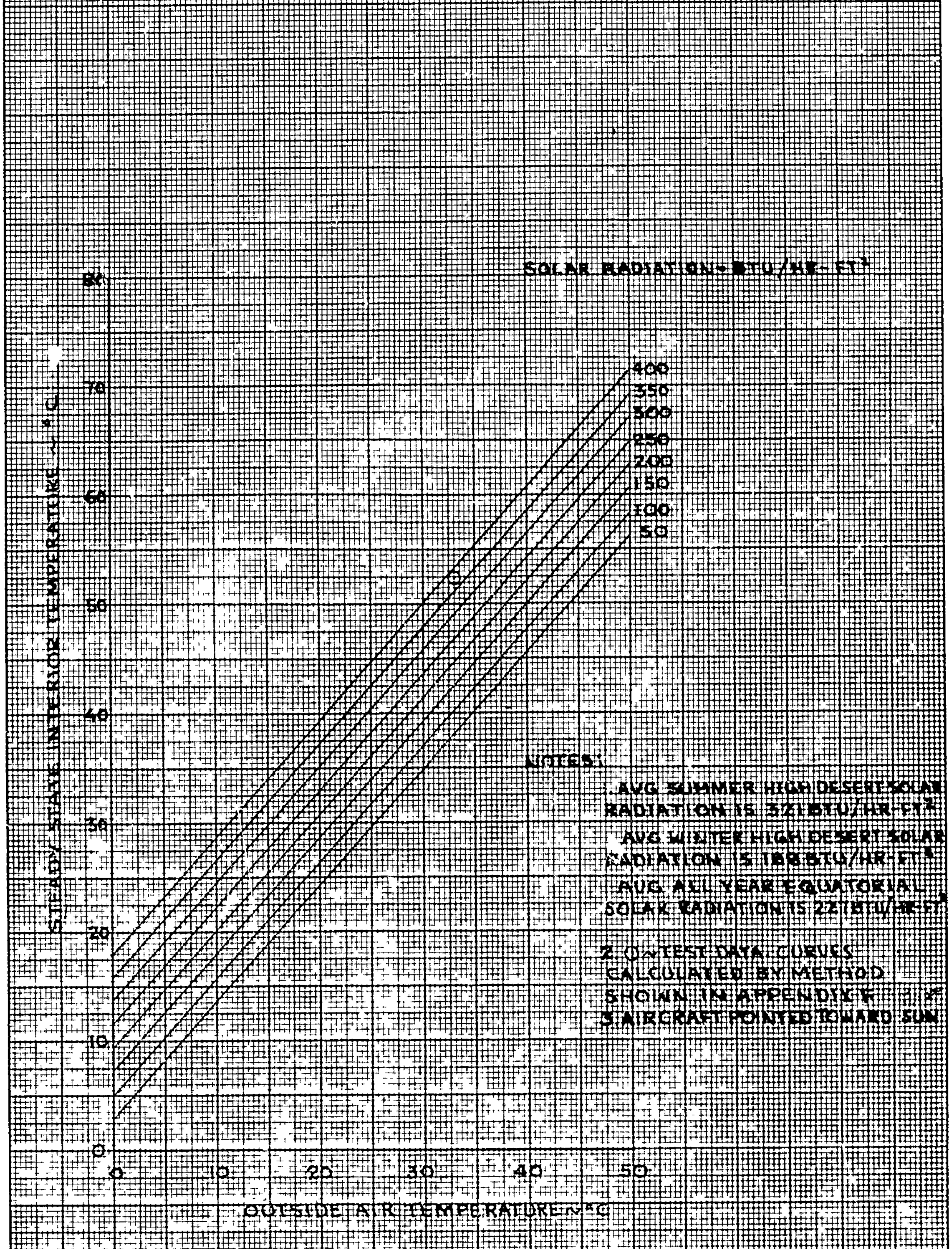


FIGURE 138
STATIC INTERIOR TEMPERATURE
UH-1H USA S/N 67-17145
AFT CABIN
SOLAR RADIATION ~ BTU/HR-FT²
400
350
300
250
200
150
100
50
STEADY STATE INTERIOR TEMPERATURE ~ °C
0
10
20
30
40
50
60
70
OUTSIDE AIR TEMPERATURE ~ °C
NOTES:
1. AVG SUMMER HIGH DESERT SOLAR RADIATION IS 321 BTU/HR-FT²
AVG WINTER HIGH DESERT SOLAR RADIATION IS 188 BTU/HR-FT²
AVG ALL YEAR EQUATORIAL SOLAR RADIATION IS 221 BTU/HR-FT²
2. O TEST DATA, CURVES CALCULATED BY METHOD SHOWN IN APPENDIX F
3. ALL VENTS AND WINDOWS CLOSED
4. VENTS AND WINDOWS OPEN WILL DECREASE TEMPERATURE BY 1°C
5. VENTS, WINDOWS AND DOORS OPEN WILL DECREASE TEMPERATURE BY 1°C
6. AVERAGE WIND SPEED 15 KTS
7. AIRCRAFT

FIGURE 139
STATIC INTERIOR TEMPERATURE
UH-1H USA S/N 67-17145
UPPER ENGINE COMPARTMENT



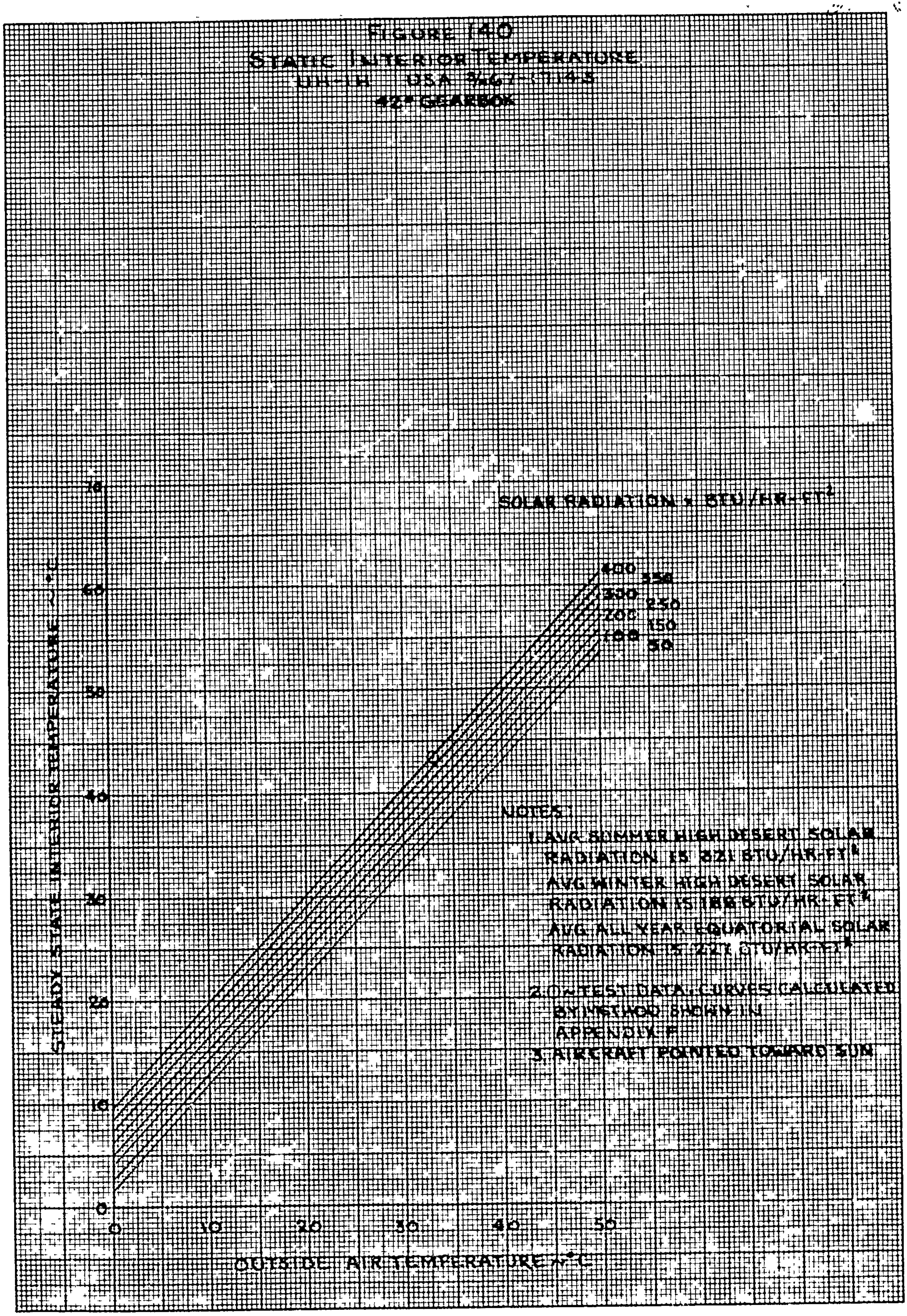


FIGURE 140
STATIC INTERIOR TEMPERATURE
UH-1H USA 3/67-17145
42° GEARBOX
SOLAR RADIATION ~ BTU/HR-FT²
400
350
300
250
200
150
100
50
NOTES:
1. AVG SUMMER HIGH DESERT SOLAR RADIATION IS 321 BTU/HR-FT²
AVG WINTER HIGH DESERT SOLAR RADIATION IS 188 BTU/HR-FT²
AVG ALL YEAR EQUATORIAL SOLAR RADIATION IS 221 BTU/HR-FT²
2. O ~ TEST DATA, CURVES CALCULATED BY METHOD SHOWN IN APPENDIX F
3. AIRCRAFT POINTED TOWARD SUN
STEADY STATE INTERIOR TEMPERATURE ~ °C
0
10
20
30
40
50
60
70
OUTSIDE AIR TEMPERATURE ~ °C

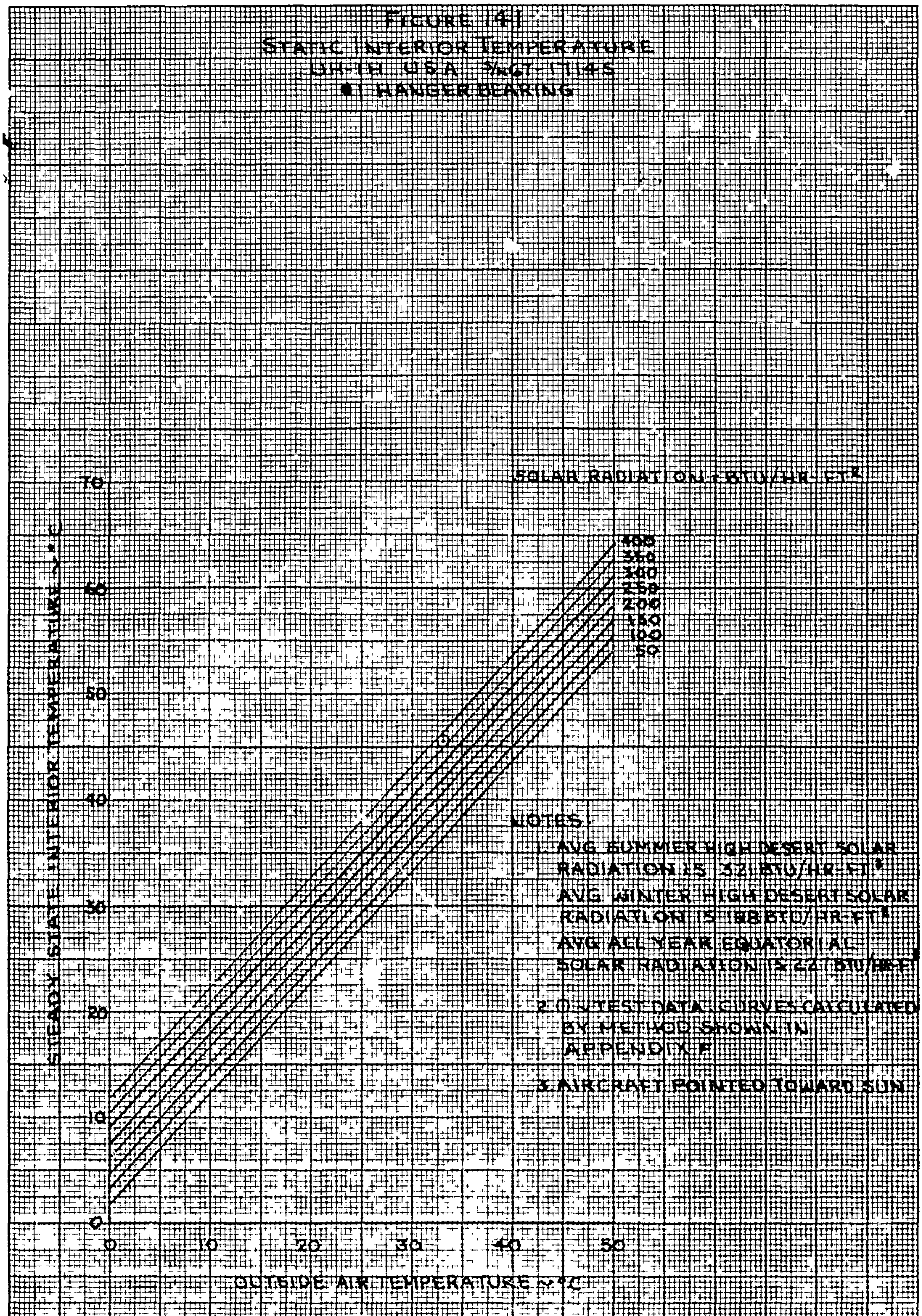


FIGURE 141
STATIC INTERIOR TEMPERATURE
UH-1H USA S/N 67-17145
#1 HANGER BEARING
SOLAR RADIATION ~ BTU/HR-FT²
400
350
300
250
200
150
100
50
STEADY STATE INTERIOR TEMPERATURE ~ °C
70
60
50
40
30
20
10
0
0
10
20
30
40
50
OUTSIDE AIR TEMPERATURE ~ °C
NOTES:
1. AVG SUMMER HIGH DESERT SOLAR RADIATION IS 321 BTU/HR-FT²
AVG WINTER HIGH DESERT SOLAR RADIATION IS 188 BTU/HR-FT²
AVG ALL YEAR EQUATORIAL SOLAR RADIATION IS 221 BTU/HR-FT²
2. O ~ TEST DATA, CURVES CALCULATED BY METHOD SHOWN IN APPENDIX F
3. AIRCRAFT POINTED TOWARD SUN

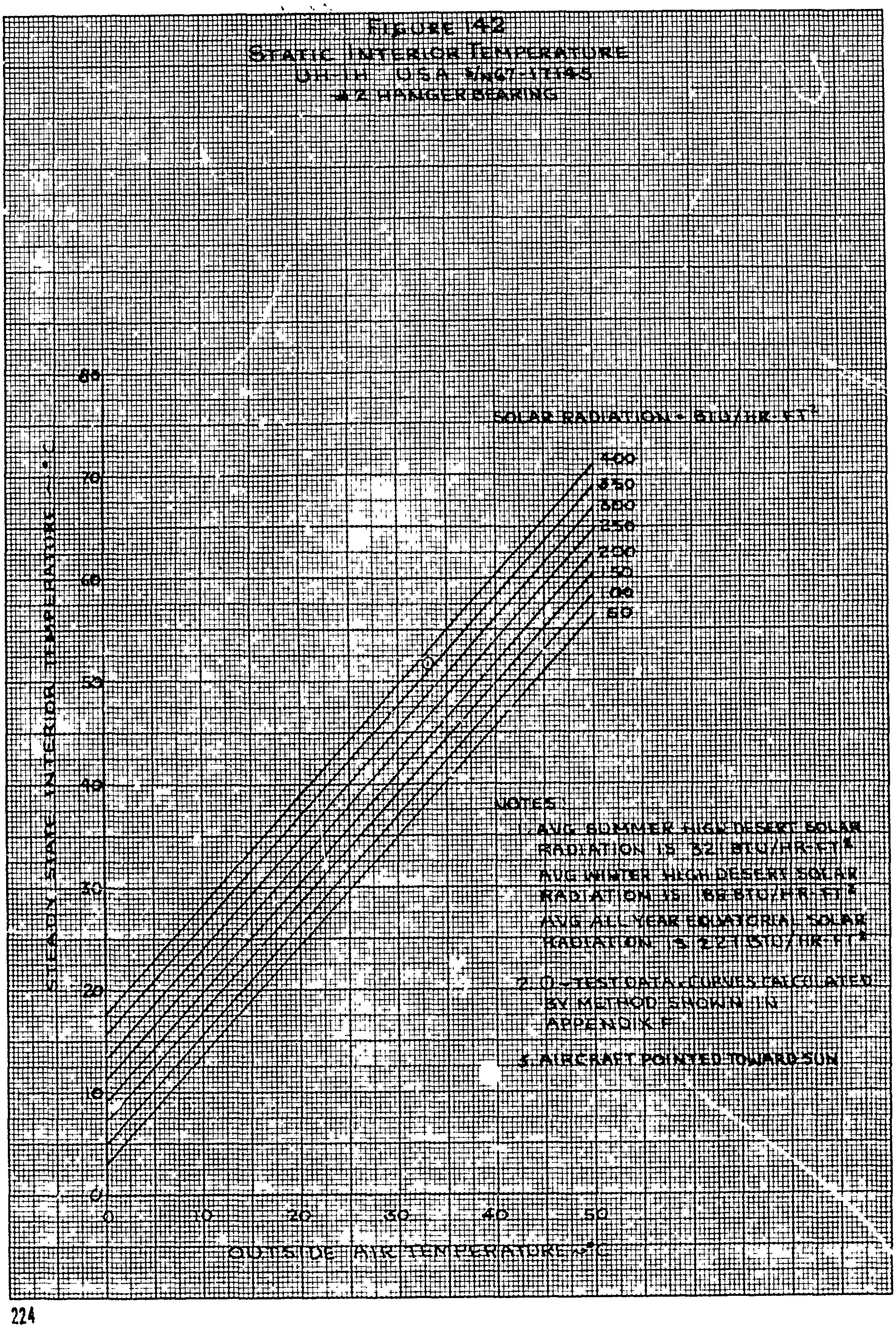
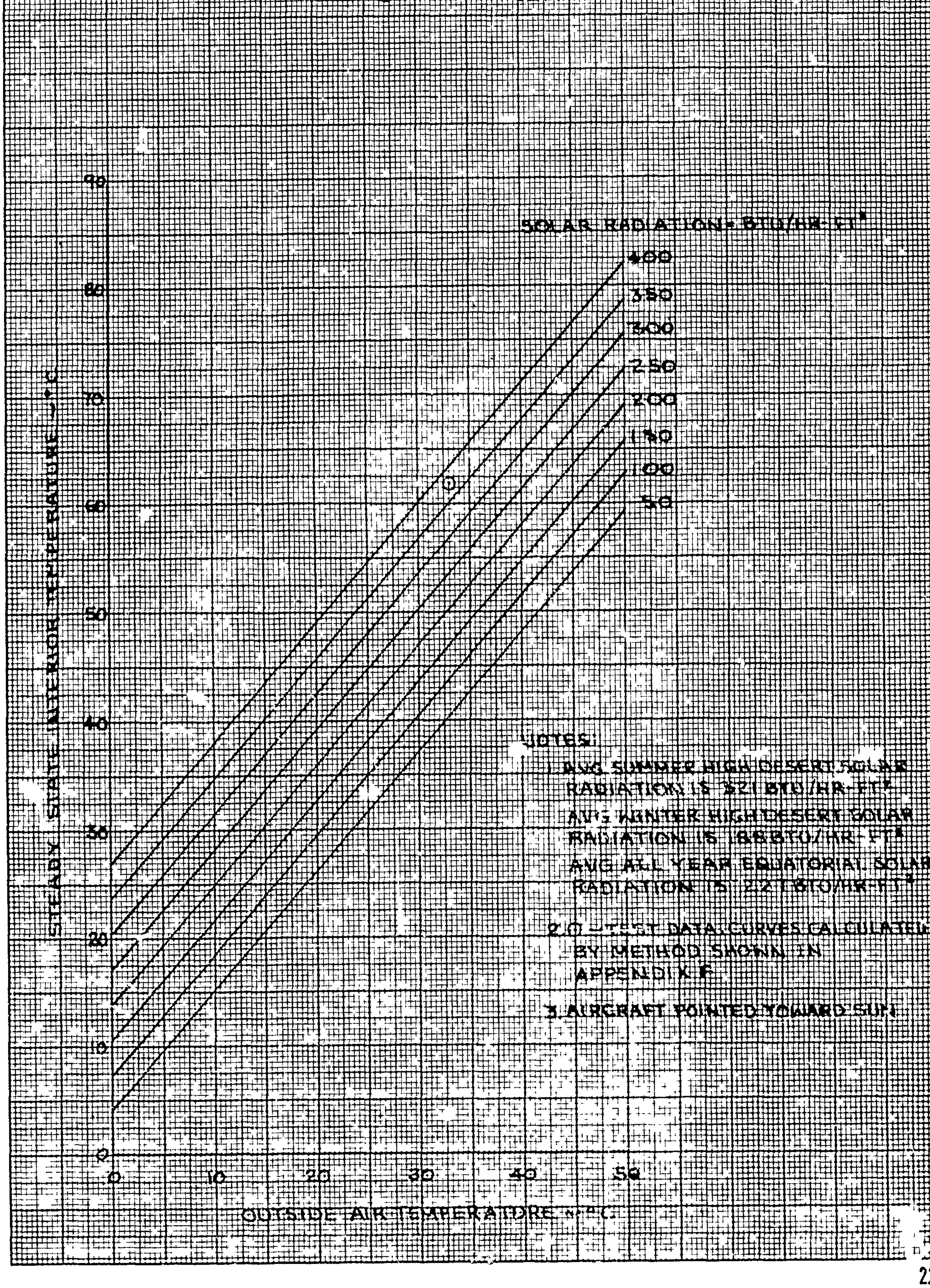


FIGURE 142
STATIC INTERIOR TEMPERATURE
UH-1H USA S/N67-17145
#2 HANGER BEARING

FIGURE 143
STATIC INTERIOR TEMPERATURE
UH-1H USA S/N 67-17145
#3 HANGER BEARING



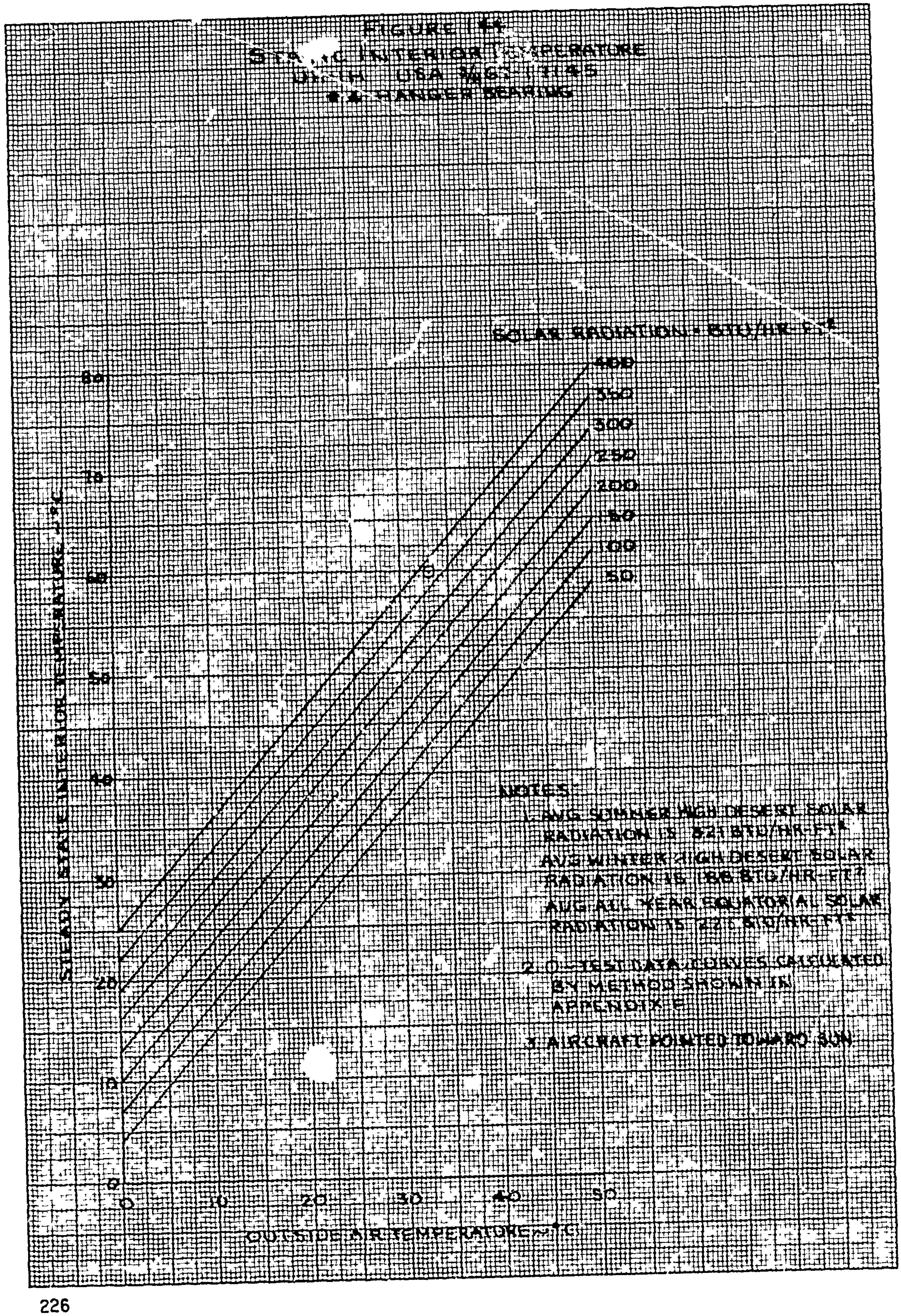


FIGURE 144
HANGER BEARING
SOLAR RADIATION - BTU/HR-FT²
400
350
300
250
200
150
100
50
0
10
20
30
40
50
60
70
80
STEADY STATE INTERIOR TEMPERATURE ~ °C
OUTSIDE AIR TEMPERATURE ~ °C
NOTES:
1. AVG SUMMER HIGH DESERT SOLAR RADIATION IS 321 BTU/HR-FT²
AVG WINTER HIGH DESERT SOLAR RADIATION IS 188 BTU/HR-FT²
AVG ALL YEAR EQUATORIAL SOLAR RADIATION IS 220 BTU/HR-FT²
2. O - TEST DATA, CURVES CALCULATED BY METHOD SHOWN IN APPENDIX E
3. AIRCRAFT POINTED TOWARD SUN

APPENDIX H. HELICOPTER VIBRATION SOURCES

There are three primary sources of vibration in present-day gas turbine-powered helicopters: the main and tail rotors; all other rotating components; and, if the helicopter is armed, gunfire. The rotor induced vibrations are of a low frequency with the fundamental frequency equal to the rotor speed. In present-day helicopters, the main rotor speed ranges from about 3 to 8 Hz with the rotor speed generally decreasing with increasing rotor diameter. A vibration occurring at the main rotor fundamental frequency is referred to as the one-per-rotor-revolution (1/rev). The rotor also induces harmonic vibrations at frequencies which are integral multiples of the number of rotor blades multiplied by the fundamental rotational frequency. Thus, a two-bladed rotor with a fundamental frequency of 5 Hz induces vibrations at frequencies of 5 Hz (1/rev), 10 Hz (2/rev), 20 Hz (4/rev), 30 Hz (6/rev), etc., and a three-bladed rotor at frequencies of 5 Hz (1/rev), 15 Hz (3/rev), 30 Hz (6/rev), 45 Hz (9/rev), etc. Normally, main rotor induced vibrations beyond the 10th harmonic, 100 Hz for a two-bladed rotor, are not significant. Rotor induced vibrations at harmonics of the rotor fundamental frequency are the predominant helicopter low-frequency vibrations and are caused by dissymetry of lift over the rotor disc which excite rotor blade structural modes and generally increase with airspeed. Vibrations are induced by all other rotating components in the helicopter. The frequencies range from the fundamental rotational frequency of the component up to geartooth, ball-bearing, and turbine-blade-passage frequencies which may range as high as 20 to 30 kilohertz. Gunfire induced vibrations are caused by recoil forces transmitted through the gun mount and by muzzle blast pressures. They have a fundamental frequency equal to the gun rate of fire and harmonics of this fundamental up to about the 20th harmonic. Typically, the highest vibration level will be at one of the gunfire harmonic frequencies. Fundamental gunfire frequencies range up to about 70 Hz.

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13. ABSTRACT

Vibration and temperature measurement tests were conducted on a production UH-1H helicopter to define the vibration and temperature environment for instruments, avionics, pilot station, and other component parts during firing and nonfiring flight. Testing was performed by the United States Army Aviation Systems Test Activity, Edwards Air Force Base, California, between 24 March and 16 June 1972. The testing consisted of 19 flights totaling 20 productive testing hours. Vibration data were recorded from 49 accelerometer locations for 55 flight conditions, and narrow-band spectral analyses were performed on the vibration data. The results of the spectral analyses were summarized by use of statistical methods. The primary source of low-frequency vibrations was the main rotor. Gunfire-induced vibrations were less than main rotor-induced vibrations. The highest vibration levels were recorded at the 42-degree gearbox at gear mesh frequencies. There were three shortcomings: amplification of main rotor-induced vibrations by avionics vibration isolation mounts, pilot station vibrations in excess of the military specification limits, and excessively high Wet Bulb Globe Temperature index at the pilot station under certain environmental conditions.

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Firing and nonfiring flight						
Low-frequency vibrations						
Main rotor						
Highest vibration levels						
42-degree gearbox						